

Einbauerklärung

nach EG-Maschinen-Richtlinie 2006/42/EG, Anhang II B

Der Hersteller / Inverkehrbringer:

KUKA Roboter GmbH
Zugspitzstrasse 140, D-86165 Augsburg

erklärt hiermit, dass das Produkt:

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668163
Steuerungstyp:	KRC4
Seriennummer Steuerung:	211005

den in Anlage 1 aufgelisteten Anforderungen der EG-Maschinen-Richtlinie 2006/42/EG und außerdem folgenden anzuwendenden Richtlinien entspricht:

Richtlinie 2004/108/EG (EMV-Richtlinie)

Ferner erklären wir, dass die speziellen technischen Unterlagen für diese unvollständige Maschine gemäß Anhang VII B erstellt wurden. Wir verpflichten uns, den Marktaufsichtsbehörden auf begründetes Verlangen die speziellen technischen Unterlagen zu übermitteln.

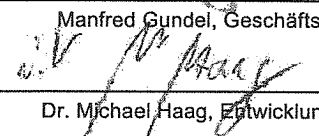
Bevollmächtigter für die Zusammenstellung der technischen Unterlagen:

Stefan Dreher, Qualität und Management Systeme
Zugspitzstraße 140, D-86165 Augsburg

Die Inbetriebnahme der unvollständigen Maschine bleibt solange unzulässig, bis die unvollständige Maschine in eine Maschine eingebaut, oder mit anderen Teilen zu einer Maschine zusammengebaut wurde, diese den Bestimmungen der EG-Maschinen-Richtlinie entspricht und die EG-Konformitätserklärung gemäß Anhang II A vorliegt.

Augsburg, 21.02.2011



Manfred Gundel, Geschäftsführer


Dr. Michael Haag, Entwicklungsleiter

Anlage 1: Liste der eingehaltenen grundlegenden Anforderungen nach Anhang I, RL 2006/42/EG
Anlage 2: Hinweise zur Montageanleitung nach Anhang VI, RL 2006/42/EG
Anlage 3: Allgemeine Sicherheitshinweise zum Produkt

Originaleinbauerklärung

135-de	geändert / edited	sachlich geprüft / checked	Freigegeben / released	Version: V04
	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

Einbauerklärung

nach EG-Maschinen-Richtlinie 2006/42/EG, Anhang II B

Der Hersteller / Inverkehrbringer:

KUKA Roboter GmbH
Zugspitzstrasse 140, D-86165 Augsburg

erklärt hiermit, dass das Produkt:

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668342
Steuerungstyp:	KRC4
Seriennummer Steuerung:	221294

den in Anlage 1 aufgelisteten Anforderungen der EG-Maschinen-Richtlinie 2006/42/EG und außerdem folgenden anzuwendenden Richtlinien entspricht:

Richtlinie 2004/108/EG (EMV-Richtlinie)

Ferner erklären wir, dass die speziellen technischen Unterlagen für diese unvollständige Maschine gemäß Anhang VII B erstellt wurden. Wir verpflichten uns, den Marktaufsichtsbehörden auf begründetes Verlangen die speziellen technischen Unterlagen zu übermitteln.

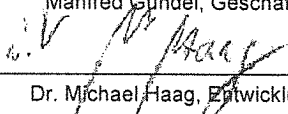
Bevollmächtigter für die Zusammenstellung der technischen Unterlagen:

Stefan Dreher, Qualität und Management Systeme
Zugspitzstraße 140, D-86165 Augsburg

Die Inbetriebnahme der unvollständigen Maschine bleibt solange unzulässig, bis die unvollständige Maschine in eine Maschine eingebaut, oder mit anderen Teilen zu einer Maschine zusammengebaut wurde, diese den Bestimmungen der EG-Maschinen-Richtlinie entspricht und die EG-Konformitätserklärung gemäß Anhang II A vorliegt.

Augsburg, 21.02.2011



Manfred Gundel, Geschäftsführer


Dr. Michael Haag, Entwicklungsleiter

Anlage 1: Liste der eingehaltenen grundlegenden Anforderungen nach Anhang I, RL 2006/42/EG
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Originaleinbauerklärung

135-de	geändert / edited	sachlich geprüft / checked	Freigegeben / released	Version: V04
	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

Liste der eingehaltenen grundlegenden Anforderungen nach Anhang I, RL 2006/42/EG

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668342
Steuerungstyp:	KRC4
Seriennummer Steuerung:	221294

Nicht relevant
Durch den Systemintegrator für die Gesamtmaschine zu leisten
Für den Umfang der unvollständigen Maschine erfüllt

Kapitel	Anforderungen			
1.	GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN			
1.1.	ALLGEMEINES			
1.1.1.	Begriffsbestimmungen			X
1.1.2.	Grundsätze für die Integration der Sicherheit	X	X	
1.1.3.	Materialien und Produkte	X	X	
1.1.4.	Beleuchtung		X	
1.1.5.	Konstruktion der Maschine im Hinblick auf die Handhabung	X	X	
1.1.6.	Ergonomie	X	X	
1.1.7.	Bedienungsplätze		X	
1.1.8.	Sitze			X
1.2.	STEUERUNGEN UND BEFEHLSEINRICHTUNGEN			
1.2.1.	Sicherheit und Zuverlässigkeit von Steuerungen	X	X	
1.2.2.	Stellteile	X	X	
1.2.3.	Ingangsetzen	X	X	
1.2.4.	Stillsetzen			
1.2.4.1.	Normales Stillsetzen	X	X	
1.2.4.2.	Betriebsbedingtes Stillsetzen	X	X	
1.2.4.3.	Stillsetzen im Notfall	X	X	
1.2.5.	Wahl der Steuerungs- oder Betriebsarten	X	X	
1.2.6.	Störung der Energieversorgung	X	X	
1.3.	SCHUTZMASSNAHMEN GEGEN MECHANISCHE GEFÄHRDUNGEN			
1.3.1.	Risiko des Verlusts der Standsicherheit	X		
1.3.2.	Bruchrisiko beim Betrieb	X		
1.3.3.	Risiken durch herabfallende oder herausgeschleuderte Gegenstände		X	
1.3.4.	Risiken durch Oberflächen, Kanten und Ecken	X		
1.3.5.	Risiken durch mehrfach kombinierte Maschinen	X	X	
1.3.6.	Risiken durch Änderung der Verwendungsbedingungen		X	
1.3.7.	Risiken durch bewegliche Teile	X	X	
1.3.8.	Wahl der Schutzeinrichtungen gegen Risiken durch bewegliche Teile		X	
1.3.8.1.	Bewegliche Teile der Kraftübertragung	X	X	
1.3.8.2.	Bewegliche Teile, die am Arbeitsprozess beteiligt sind		X	
1.3.9.	Risiko unkontrollierter Bewegungen	X	X	
1.4.	ANFORDERUNGEN AN SCHUTZEINRICHTUNGEN			
1.4.1.	Allgemeine Anforderungen		X	
1.4.2.	Besondere Anforderungen an trennende Schutzeinrichtungen		X	
1.4.2.1.	Feststehende trennende Schutzeinrichtungen		X	
1.4.2.2.	Bewegliche trennende Schutzeinrichtungen mit Verriegelung		X	

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	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

Kapitel	Anforderungen			
1.4.2.3.	Zugangsbeschränkende verstellbare Schutzeinrichtungen		X	
1.4.3.	Besondere Anforderungen an nichttrennende Schutzeinrichtungen		X	
1.5.	RISIKEN DURCH SONSTIGE GEFÄHRDUNGEN			
1.5.1.	Elektrische Energieversorgung	X	X	
1.5.2.	Statische Elektrizität	X	X	
1.5.3.	Nichtelektrische Energieversorgung		X	
1.5.4.	Montagefehler	X	X	
1.5.5.	Extreme Temperaturen	X	X	
1.5.6.	Brand	X	X	
1.5.7.	Explosion			X
1.5.8.	Lärm	X	X	
1.5.9.	Vibrationen			X
1.5.10.	Strahlung	X		
1.5.11.	Strahlung von außen	X		
1.5.12.	Laserstrahlung		X	
1.5.13.	Emission gefährlicher Werkstoffe und Substanzen	X	X	
1.5.14.	Risiko, in einer Maschine eingeschlossen zu werden		X	
1.5.15.	Ausrutsch-, Stolper- und Sturzrisiko		X	
1.5.16.	Blitzschlag	X	X	
1.6.	INSTANDHALTUNG			
1.6.1.	Wartung der Maschine	X	X	
1.6.2.	Zugang zu den Bedienungsständen und den Eingriffspunkten für die Instandhaltung		X	
1.6.3.	Trennung von den Energiequellen	X	X	
1.6.4.	Eingriffe des Bedienungspersonal		X	
1.6.5.	Reinigung innen liegender Maschinenteile		X	
1.7.	INFORMATIONEN			
1.7.1.	Informationen und Warnhinweise an der Maschine	X	X	
1.7.1.1.	Informationen und Informationseinrichtungen	X	X	
1.7.1.2.	Warneinrichtungen		X	
1.7.2.	Warnung vor Restrisiken		X	
1.7.3.	Kennzeichnung der Maschinen		X	
1.7.4.	Betriebsanleitung		X	
1.7.4.1.	Allgemeine Grundsätze für die Abfassung der Betriebsanleitung		X	
1.7.4.2.	Inhalt der Betriebsanleitung		X	
1.7.4.3.	Verkaufsprospekte	X	X	
2.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN BESTIMMTE MASCHINENGATTUNGEN			
2.1.	NAHRUNGSMITTELMASCHINEN UND MASCHINEN FÜR KOSMETISCHE ODER PHARMAZEUTISCHE ERZEUGNISSE			X
2.2.	HANDGEHALTENE UND/ODER HANDGEFÜHRTE TRAGBARE MASCHINEN			X
3.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN ZUR AUSSCHALTUNG DER GEFÄHRDUNGEN, DIE VON DER BEWEGLICHKEIT VON MASCHINEN AUSGEHEN			X
4.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN ZUR AUSSCHALTUNG DER DURCH HEBEVORGÄNGE BEDINGTEN GEFÄHRDUNGEN			X
5.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN MASCHINEN, DIE ZUM EINSATZ UNTER TAGE BESTIMMT SIND			X
6.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN MASCHINEN, VON DENEN DURCH DAS HEBEN VON PERSONEN BEDINGTE GEFÄHRDUNGEN AUSGEHEN			X

Hinweise zur Montageanleitung nach Anhang VI, RL 2006/42/EG

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668342
Steuerungstyp:	KRC4
Seriennummer Steuerung:	221294

Die Montageanleitung gibt dem, der oben genannte unvollständige Maschine in eine Maschine einbaut oder mit anderen Teilen zu einer vollständigen Maschine zusammenbaut, die notwendigen Informationen, insbesondere über die sicherheitsrelevanten Schnittstellen, für den ordnungsgemäßen Zusammenbau ohne Beeinträchtigung der Sicherheit und Gesundheit von Personen.

Zusätzlich zu dieser Montageanleitung sind die relevanten europäischen Richtlinien und nationalen Vorschriften zu beachten.

Zur Übereinstimmung mit den grundsätzlichen Anforderungen der EG-Maschinen-Richtlinie wird empfohlen, die beiden Normen für Industrieroboter-Sicherheitsanforderungen EN ISO 10218-1 und EN ISO 10218-2 anzuwenden.

Die Montageanleitung zusammen mit der Einbauerklärung und deren Anhängen, verbleibt bei der unvollständigen Maschine bis zu ihrem Einbau in die vollständige Maschine und ist danach den technischen Unterlagen der vollständigen Maschine beizufügen.

Die Montageanleitung selbst befindet sich in elektronischer Form auf einem beigelegten Datenträger. Zum Lesen wird ein PC mit einem entsprechenden Programm zum Darstellen von PDF-Dateien benötigt.

Die wichtigsten Inhalte der Montageanleitung sind im Anhang 3 Allgemeine Sicherheitshinweise zum Produkt zusammengefasst. Diese Inhalte befinden sich ebenfalls in der vollständigen Montageanleitung zur entsprechenden Komponente.

Zu jeder Komponente des Industrieroboters (Manipulator, Steuerung, Optionen) befindet sich eine eigenständige und vollständige Montageanleitung auf dem Datenträger, die über die Typenbezeichnung eindeutig zu identifizieren ist.

Sollte es nicht möglich sein den Datenträger zu lesen, kontaktieren Sie bitte unsere Hotline:

Tel.: +49 821 797 1926

Email: hotline@kuka-roboter.de

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	2011-02-21	2011-02-21	2011-02-21	

Declaration of Conformity / Konformitätserklärung

in acc. to the pressure equipment directive 97/23/EC
nach Druckgeräterichtlinie 97/23/EG



Type*	Nominal size Nennweite	EC-type examination No. EG-Baumusterprüfnummer
DBC 6 HKE 017	6	P-IS-DBB-MAN-12-10-10284661-001

* see name plate / siehe Typenschild

category IV

applied category in acc. to article 3 and annex II / angewandte Kategorie nach Artikel 3 und Anhang II

module / Modul	conformity assessment procedures / Konformitätsbewertungsverfahren	certificate number / Bescheinigungsnummer
B	EC type-examination / EG-Baumusterprüfung	P-IS-DBB-MAN-12-10-10284661-001
F	inspection of the products / Prüfung der Produkte	see conformity certificate / siehe Konformitätsbescheinigung

conformity assessment procedures in acc. to article 10 / angewandte Konformitätsbewertungsverfahren nach Artikel 10

module / Modul B: Zertifizierungsstelle für Druckgeräte des TÜV Süd Industrie Service GmbH
identification number: 0036, Dudenstraße 28, D-68167 Mannheim / Germany
name and address of the notified body (monitoring a.m. conformity assessment procedures)
Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

module / Modul F: Zertifizierungsstelle für Druckgeräte des TÜV Süd Industrie Service GmbH
identification number: 0036, Gottlieb-Daimler-Str. 7, D-70794 Filderstadt / Germany
name and address of the notified body (monitoring a.m. conformity assessment procedures)
Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment is in accordance to the requirements of the pressure equipment directive. Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entspricht.

at the moment no harmonized standards available
zur Zeit keine harmonisierten Normen verfügbar

applied harmonized standards / angewandte harmonisierte Normen

AD-Merkblatt 2000 A2, TRD 801 Nr. 45

other applied standards or technical rules / angewandte andere Normen oder technische Spezifikationen

25.10.2012
date
Herion-Systemtechnik GmbH
Untere Talstr. 65, 71263 Weil der Stadt
manufacturer stamp
authorized subscriber



Sitz der Gesellschaft: Weil der Stadt - Registergericht: Amtsgericht Stuttgart HRB 252794

Geschäftsführer: Jean-Marie Baumann

The Royal Bank of Scotland
BLZ 300 308 60, Kto.-Nr. 050 0191 015
SWIFT-Code: RBSGDE33
IBAN: DE71 5023 0400 1809 1650 04

HSBO Treuhaus & Buchardt AG
BLZ 300 308 60, Kto.-Nr. 050 0191 015
SWIFT-Code: TUBSD333
IBAN: DE05 3003 0880 0500 1910 15

Ein Unternehmen der IMH-Gruppe

IMI

Ust-ID-Nr. DE 811 188 594

ZERTIFIKAT ◆ CERTIFICADO ◆ CERTIFONKAT ◆ ZERTIFIKAT ◆



Industrie Service

ZERTIFIKAT

(Konformitätsbescheinigung)
Certificate of conformity

Prüfung des Produktes (Modul F) nach Richtlinie 97/23/EG
Product Verification (Module F) according to Directive 97/23/EC

Zertifikat-Nr.: Z-IS-ATA6-12-10-284661-385
Certificate No.:

Name und Anschrift
des Herstellers:
Name and postal address of manufacturer:

Herion Systemtechnik GmbH
Untere Talstr. 65
71263 Weil der Stadt

Hiermit wird bescheinigt, dass die Ergebnisse der an dem unten genannten Druckgerät vorgenommenen Prüfungen die Anforderungen der Richtlinie 97/23/EG erfüllen. Das Druckgerät entspricht dem Baumuster und ist mit unserer Kennnummer gemäß dem abgebildeten CE-Kennzeichen gekennzeichnet. We herewith certify that the results of the examinations of the pressure equipment meet the requirements of the directive 97/23/EC. The pressure equipment complies with the EC type examination and carries our identification number to the CE-mark as illustrated.

CE 0036

Prüfbericht Nr.:
Test report No.:

P-IS-ATA6-12-10-284661-385

Geltungsbereich:
Scope of examination:

Direkt wirkendes federbelastetes
Sicherheitsventil für Hydraulik-
flüssigkeiten
Fabrikations-Nr. 1242207 - 124240
Typ DBC6HKE990171F0

Fertigungsstätte:
Manufacturing plant:

Herion Systemtechnik GmbH
Untere Talstr. 65
71263 Weil der Stadt

TÜV SÜD Industrie Service GmbH
Zertifizierungsstelle
für Druckgeräte



Filderstadt, 25. Oktober 2012
(Ort, Datum)

Bitte beachten Sie die Hinweise auf der zweiten Seite:
Please note the remarks on the second page:

Benannte Stelle, Kennnummer 0036
Notified Body, No. 0036

Tel.: (07 11) 70 05-2 81
Fax: (07 11) 70 05-6 81
www.tuev-sued.de

TÜV SÜD Industrie Service GmbH
Region Baden-Württemberg
Bereich Anlagentechnik
Abteilung Werkstoff und Schweißtechnik
Gottlieb-Daimler-Straße 7
D-70794 Filderstadt

Mitglied der

CONFÉDÉRATION EUROPÉE

CEOC

D'ORGANISMES DE CONTRÔLE

ÖLHYDRAULIK ALTENERDING
Dechamps & Kretz GmbH & Co. KG
Albert-Einstein-Straße 10 - 12
D-85435 Erding

Formular-Nr.
MO-017

Der Hersteller der Baugruppe Gewichtsausgleich mit den nachstehenden Angaben:
The manufacturer of the assembly (Counterweight) with the following information:
Le fabricant de l'assemblage (contrepoids) ci-dessous:

Hersteller / Manufacturer / Fabricant:	ÖLHYDRAULIK ALTENERDING; Dechamps & Kretz GmbH & Co. KG		
Herstellerzeichen: Manufacturer's logo: Marque du fabricant:		Herstelljahr: Year of manufacture: Anne de fabrication:	2012
Baugruppe Gewichtsausgleich: Assembly (counterweight): Assemblage (contrepoids):	Serienr. / Serial number / N° de Serie:	000153.02.1	
	Type:	GA14	
Max. zulässiger Druck [PS] in bar Maximum allowable pressure [PS] in bar / Pression maximale admissible en bar:		330	
Inhalt in l / Capacity in l / Capacité en l:		3,5	
Zulässige max./min. Temperatur [TS] in °C Allowable max./min. temperature [TS] in °C / Température max./min. admissible en °C:		+ 55 / - 10	
Druckschwankungsbreite / Pressure fluctuation / Fluctuation de pression:		169 ... 312 bar	
Zulässige Lastwechsel / Allowable load variation / Variation de charge admissible:		> 2 x 10⁶	

Der unterzeichnende Hersteller bescheinigt hiermit, dass die Baugruppe den Anforderungen der Druckgeräterichtlinie 97/23/EG entspricht.
The undersigned manufacturer certifies that the assembly correspond to the requirements of the pressure equipment directive 97/23/EG.
Le fabricant soussigné confirme, que l'assemblage se correspond aux exigences de la directive des équipements sous pression 97/23/EG

Kategorie der Baugruppe / Assembly denomination / Catégorie d'assemblage:	III		
Konformitätsbewertungsverfahren: Conformity assessment procedure: Procédures d'évaluation de la conformité:	EG-Baumusterprüfung und Konformität der Bauart. CE type examination and conformity of the design. Examen de type CE et conformité de la conception. Modul B + C1		

Die Überwachung erfolgt durch die benannte Stelle:
Monitoring is carried out by a notified center / La surveillance est effectuée par un organisme notifié.

TÜV Industrie Service GmbH, TÜV Süd Gruppe, 80686 München	
Kenn-Nr. / Characteristics-No. / Caractéristiques-N°:	CE 0036
angewandte harmonisierte Normen / Applied harmonized standards / Normes harmonisées appliquées:	---
angewandte sonstige Normen oder techn. Spezifikationen: Other standards or technical specifications applied / Autres normes ou spécifications techniques appliquées:	AD 2000 Regelwerk
angewandte Gemeinschaftsrichtlinien / Applied community guidelines / Lignes directrices appliquées:	---

Anlagen / Attachments / Annexe:

- Beschreibung der Baugruppe und Prüfprotokoll MO-018 / Description of the assembly and test report MO-018 / Description de l'assemblage et rapport d'essais MO-018
- Konformitätserklärung zum Druckspeicher von Fa. HYDAC / Certificate of conformity of the pressure accumulator from the Co. HYDAC / Certificat de conformité de l'accumulateur de pression de la Ste. HYDAC
- Konformitätserklärung zum Sicherheitsventil von Fa. HERION / Certificate of conformity of safety valves from the Co. HERION / Certificat de conformité des soupapes de sécurité de la Ste. HERION
- Konformitätsbescheinigung zum Sicherheitsventil von TÜV Industrie Service / Certificate of conformity to the safety valve of TÜV Industrie Service / Certificat de conformité à la soupape de sécurité du TÜV Industrie Service
- Technische Dokumentation der Baugruppe Gewichtsausgleich (Fa. ÖLHYDRAULIK ALTENERDING) / Technical documentation of the assembly / counterweight (Co. ÖLHYDRAULIK ALTENERDING) / Documentation technique de l'assemblage / contrepoids (Ste. ÖLHYDRAULIK ALTENERDING)
- Technische Dokumentation für Speichersicherheitsventile / Technical documentation for safety valves accumulator / Documentation technique pour l'accumulateur à soupape de sécurité (Fa. / Co. / Ste. HERION)
- Betriebsvorschrift für Einbau und Wartung von Hydrospeicher (Fa. HYDAC) / Instructions for installation and maintenance of Hydraulic accumulators (Co. HYDAC) / Mode d'emploi pour l'installation et maintenance des accumulateurs Hydrauliques (Ste. HYDAC)

Erding, 12.07.12

Herstellerstempel / Stamp of the manufacturer / Tampon du fabricant:

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO.
Postfach 11 52 Tel. (0 81 22) 97 13 - 0
85421 ERDING Fax (0 81 22) 97 13 27

Unterschrift Werkssachverständiger:
Signature Plant expert:
Signature Expert de la plant:

Ausg. 2-9/2002
10.09.2002

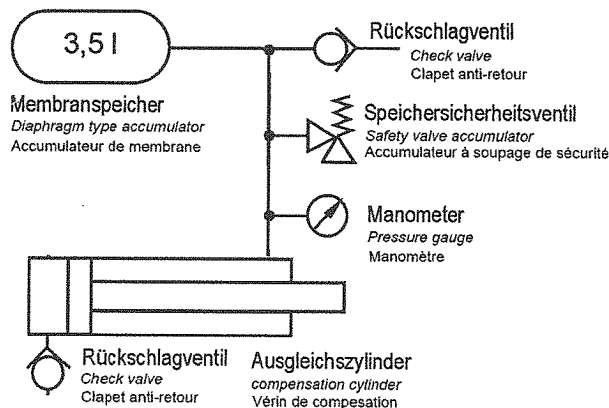
ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO. KG

Verteiler: Original - Kunde, Kopie VK

1. Gewichtsausgleich / Counterweight / Contrepoids

Type: GA14
 ÖA-Zg.-Nr. / ÖA-drawing-No. / ÖA-dessin n°: 1144.00.000
 KUKA-Zg.-Nr. / KUKA-drawing-No. / ÖA-dessin n°: 394.056-06.010.10
 KUKA-Sachnr. / KUKA-Item No. / KUKA-N° art.: 00-183-637

Seriennummer:
 Serial No.: **000347.02.1**
 Numéro de série:

2. Anschlußschema / Connection diagram / Schéma de raccordement

3. Bestandteile der Baugruppe / Assembly components / Composantes de l'assemblée

Bezeichnung Designation Désignation	Hersteller Manufacturer Fabricant	Typ Type Type	Kategorie nach Art. 9 der DGRL Category according to the article 9 of the PED Catégorie selon l'article 9 de la DESP	Abnahme nach Modul Approval to module Réception selon le module
Membranspeicher Diaphragm type accumulator Accumulateur de membrane	HYDAC	SBO 330-3,5 ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530069 Seriennr. / Serial No. / Numéro de série: 0404847	III	B + D
Ausgleichszylinder mit Anschlußflansch Compensating cylinder with flange Vérin de compensation avec Bride	ÖLHYDRAULIK	1144.01.000	Ausnahme nach Art. 1, 3.10 der DGRL Exception in accordance with article 1, 3.10 of the PED Exception dans l'article 1, 3.10 de la DESP	---
Rückschlagventil Check valve Clapet anti-retour	Voss	ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 1000.05.000	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---
Speichersicherheitsventil Check valve Clapet anti-retour	Herion	TÜV.SV.00-527.6.F.70.330 ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530072 Seriennr. / Serial No. / Numéro de série: 1242290	IV	B + F
Manometer Pressure gauge Manomètre	WIKA	0 - 400 bar rote Markierung bei 330 bar ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 510114	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---
Rückschlagventil Check valve Clapet anti-retour	Parker Ermeto	RHV 10 LME OMD A3C ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530079	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---

4. Durchgeführte Tests und Prüfungen / Performed tests and checks / Tests et contrôles effectués

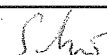
- Druckprüfung des Zylinders mit 330 bar (nur bei 10 %)
Pressure test of the cylinder at 330 bar (only 10 % is required)
Pression d'essai dans les vérins: 330 bar (seulement le 10 % est nécessaire) Nein / no / no
- Spülen des kompletten Gewichtsausgleiches / Rinse the entire counterweight / Rinçage complet du contrepoids Ja / yes / oui
- Befüllen und Entlüften / Filling and bleeding / Remplissage et purge Ja / yes / oui
- Druckeinstellung des Öldruckes auf / Pressure setting of the oil pressure on /
Réglage de la pression d'huile sur 185 bar
- Stickstoffdruck p0 / Nitrogen pressure / Pression d'azote 162 bar

5. Bemerkungen / Comments / Commentaires

Der max. zulässige Druck [PS] für die Baugruppe beträgt 330 bar!

Datum / Date / Date: 16.02.13

Unterschrift des Prüfers

Signature of Inspector / Signature du contrôleur: 

Ausg. 4-10/2002
23.10.2002

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO. KG

Verteiler: Original - Kunde, Kopie VK

ÖLHYDRAULIK ALTENERDING
Dechamps & Kretz GmbH & Co. KG
Albert-Einstein-Straße 10 - 12
D-85435 Erding

Formular-Nr.
MO-017

Der Hersteller der Baugruppe Gewichtsausgleich mit den nachstehenden Angaben:
The manufacturer of the assembly (Counterweight) with the following information:
Le fabricant de l'assemblage (contrepoids) ci-dessous:

Hersteller / Manufacturer / Fabricant:		ÖLHYDRAULIK ALTENERDING; Dechamps & Kretz GmbH & Co. KG	
Herstellerzeichen: Manufacturer's logo: Marque du fabricant:		Herstelljahr: Year of manufacture: Anne de fabrication:	2013
Baugruppe Gewichtsausgleich: Assembly (counterweight): Assemblage (contrepoids):	Seriennr. / Serial number / N° de Serie:	000347.02.1	
	Type:	GA14	
Max. zulässiger Druck [PS] in bar Maximum allowable pressure [PS] in bar / Pression maximale admissible en bar:			330
Inhalt in l / Capacity in l / Capacité en l:			3,5
Zulässige max./min. Temperatur [TS] in °C Allowable max./min. temperature [TS] in °C / Température max./min. admissible en °C:			+ 55 / - 10
Druckschwankungsbreite / Pressure fluctuation / Fluctuation de pression:			169 ... 312 bar
Zulässige Lastwechsel / Allowable load variation / Variation de charge admissible:			> 2 x 10 ⁶

Der unterzeichnende Hersteller bescheinigt hiermit, dass die Baugruppe den Anforderungen der Druckgeräterichtlinie 97/23/EG entspricht.
The undersigned manufacturer certifies that the assembly correspond to the requirements of the pressure equipment directive 97/23/EG.
Le fabricant soussigné confirme, que l'assemblage se correspond aux exigences de la directive des équipements sous pression 97/23/EG

Kategorie der Baugruppe / Assembly denomination / Catégorie d'assemblage:	III		
Konformitätsbewertungsverfahren: Conformity assessment procedure: Procédures d'évaluation de la conformité:	EG-Baumusterprüfung und Konformität der Bauart. CE type examination and conformity of the design. Examen de type CE et conformité de la conception. Modul B + C1		

Die Überwachung erfolgt durch die benannte Stelle:
Monitoring is carried out by a notified center / La surveillance est effectuée par un organisme notifié.

TÜV Industrie Service GmbH, TÜV Süd Gruppe, 80686 München	
Kenn-Nr. / Characteristics-No. / Caractéristiques-N°:	CE 0036
angewandte harmonisierte Normen / Applied harmonized standards / Normes harmonisées appliquées:	---
angewandte sonstige Normen oder techn. Spezifikationen: Other standards or technical specifications applied / Autres normes ou spécifications techniques appliquées:	AD 2000 Regelwerk
angewandte Gemeinschaftsrichtlinien / Applied community guidelines / Lignes directrices appliquées:	---

Anlagen / Attachments / Annexe:

- Beschreibung der Baugruppe und Prüfprotokoll MO-018 / Description of the assembly and test report MO-018 / Description de l'assemblage et rapport d'essais MO-018
- Konformitätserklärung zum Druckspeicher von Fa. HYDAC / Certificate of conformity of the pressure accumulator from the Co. HYDAC / Certificat de conformité de l'accumulateur de pression de la Ste. HYDAC
- Konformitätserklärung zum Sicherheitsventil von Fa. HERION / Certificate of conformity of safety valves from the Co. HERION / Certificat de conformité des soupapes de sécurité de la Ste. HERION
- Konformitätsbescheinigung zum Sicherheitsventil von TÜV Industrie Service / Certificate of conformity to the safety valve of TÜV Industrie Service / Certificat de conformité à la soupape de sécurité du TÜV Industrie Service
- Technische Dokumentation der Baugruppe Gewichtsausgleich (Fa. ÖLHYDRAULIK ALTENERDING) / Technical documentation of the assembly / counterweight (Co. ÖLHYDRAULIK ALTENERDING) / Documentation technique de l'assemblage / contrepoids (Ste. ÖLHYDRAULIK ALTENERDING)
- Technische Dokumentation für Speichersicherheitsventile / Technical documentation for safety valves accumulator / Documentation technique pour l'accumulateur à soupape de sécurité (Fa. / Co. / Ste. HERION)
- Betriebsvorschrift für Einbau und Wartung von Hydrospeicher (Fa. HYDAC) / Instructions for installation and maintenance of Hydraulic accumulators (Co. HYDAC) / Mode d'emploi pour l'installation et maintenance des accumulateurs Hydrauliques (Ste. HYDAC)

Erding, 16.02.13

Herstellerstempel / Stamp of the manufacturer / Tampon du fabricant:

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO.
Postfach 11 52 Tel. (0 81 22) 97 13 - 0
85421 ERDING Fax (0 81 22) 97 13 27

Unterschrift Werkssachverständiger:
Signature Plant expert:
Signature Expert de la plant:

Ausg. 2-9/2002
10.09.2002

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO. KG

Verteiler: Original - Kunde, Kopie VK

1 KONFORMITÄTSERKLÄRUNG
nach Druckgeräterichtlinie 97/23/EGDeclaration of Conformity acc. to Pressure Equipment Directive 97/23/EC
Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CEHYDAC TECHNOLOGY GMBH
Postfach 1251, D-66273 Sulzbach/Saar
Industriegebiet, D-66280 Sulzbach/Saar
Telefon (06897) 509-01
Telefax (06897) 509-454
E-Mail: speichertechnik@hydac.com**2 Druckbehälter**

Pressure Vessel / Récipient sous pression

Bescheinigung Nr.

Certificate no. / N° du Certificat

2013-A / M- 0428

HYDAC Auftrags-Nr.

HYDAC Order no./N° contrat HYDAC

8308118012 / 020

3 Beschreibung

Description / Description

Membranspeicher / Diaphragm accumulator / Accumulateur à membrane

Stückzahl

Quantity/Quantité

150

4 Typ

Type / Type

SBO330-3,5E1/112UA9-330MF098

Artikel-Nr.

Stock no./Code article

3658960

Baujahr

Year built/Année de fabrication

2013

5 Seriennummer

Serial no./N° de série

0404748 bis/to/à 0404897

6 Zeichnungs-Nr.

Drawing no./N° de plan

03042029

Index

Index/Indice

d

Rauminhalt (V)

Volume/Volume

3,5

L

Korrosionszuschlag

Corrosion all./Surépais. de corr.

0

mm

7 Auslegungsdruck (PD)

Design pressure/Pression de calcul

330

bar

Auslegungstemperatur (TD)

Design Temperature/Température de calcul

-40/150

°C

8 Maximal zulässiger Druck (PS)max. permissible Operating Pressure
Pression max de Service admissible

330

bar

Zulässige minimale/maximale Temperatur (TS)

min/max permissible operating temperature
Température min/max de service admissible

-10/80

°C

9 Prüfdruck (PT)

Test pressure / Pression d'épreuve

472

bar

Kategorie

Category/Catégorie

III

Verwendete Module

Modules followed/Modules utilisés

B + D

10 Betriebsmedium

Operating fluid/Fluides admissibles en service

Fluid Gruppe 2 / Fluids in Group 2 / Fluides du Groupe 2

11 Prüfstelle für

Inspection Authority for/Organisme pour

☐ Entwurfsprüfung

Design Approval/Approbation de Conception

☒ Baumusterprüfung

Type Approval/Approbation de Type

12 Name

Name/Nom

TÜV Saarland e.V.

Adresse

Address/Adresse

D - 66280 Sulzbach / Saar

13 Kenn.-Nr.

Ident.no./N° d'identification

0034

Zertifikat-Nr.

Certificate no./N° de Certificat

6020/00/0101-3 Rev. 1

Datum

Date/Date

2004-03-02

14 Prüfstelle für die Abnahme (Schlussprüfung und Druckprüfung)

Inspection Authority for final assessment (Final inspection and Proof test)/Organisme pour la vérification finale (Examen final et Epreuve)

15 Name

Name/Nom

HYDAC Technology GmbH

Adresse

Name/Nom

D - 66280 Sulzbach / Saar

16 Kenn.-Nr.

Ident.no./N° d'identification

Zertifikat-Nr.

Certificate no./N° de Certificat

Datum

Date/Date

2013-02-04

17 Prüfstelle für die Zertifizierung des QM-Systems

Inspection Authority for the certification of the Quality System / Organisme pour l'évaluation du Système Qualité.

18 Name

Name/Nom

SGS-TÜV GmbH

Adresse

Name/Nom

D - 66280 Sulzbach / Saar

19 Kenn.-Nr.

Ident.no./N° d'identification

1637

Zertifikat-Nr.

Certificate no./N° de Certificat

71 202 09 Q 0051

Datum

Date/Date

2012-02-29

20 Der Hersteller, HYDAC Technology GmbH, bescheinigt, daß Konstruktion, Herstellung und Prüfung dieser (dieses) Druckbehälter(s) den Anforderungen der EG-Druckgeräterichtlinie 97/23/EG erfüllen.

The manufacturer, HYDAC Technology GmbH, certifies that the Design, Manufacture and Inspection of this (these) Pressure Vessel(s) comply with the requirements of the Directive 97/23/EC.

Le Fabricant, HYDAC Technology GmbH, certifie que, la Conception, la Fabrication et l'Inspection du(des) récipient(s) sont conformes aux exigences de la Directive 97/23/CE.

21 Angewandte Normen und techn. Spezifikationen:Standards and technical specifications used
Normes et spécifications techniques utilisées

AD-2000 Regelwerk

22 Bemerkungen

Remarks/Remarques

zul. Druckschwankungsbreite/permissible range of pressure fluctuations/plage d'oscillation de la pression admissible:
bis/till/jusqu'à 100 °C $\Delta p = 235$ bar (95-330 bar) bei/for/pour N = 2.000.000 Lastwechsel/cycles/cycles**23 Datum**

Date/Date

2013-02-04

Position

Position/Position

Werkssachverständiger

Name

Name/Nom

Banaszak F.

24 Stempel der HerstellerfirmaManufacturer's Stamp
Cachet du Fabricant

HYDAC TECHNOLOGY GMBH

25 AnlagenAttachments
Documents joints- Betriebsanleitung / Instruction manual / Manuel d'instruction
- Zeichnung / Drawing / Plan

Unterschrift

Signature/signature

Übersetzungen zur Konformitätserklärung nach Druckgeräterichtlinie 97/23/EG : Druckbehälter

Translations of the Declaration of Conformity acc. to Pressure Equipment Directive 97/23/CE : Pressure Vessel

Traductions de la Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CE : Récipient sous pression

1. Prohlášení o shodě dle směrnice č. 97/23/EG pro tlaková zařízení		CS	1. PROHLÁŠENÍ O SHODĚ podle Směrnice o tlakových zařízeních 97/23/ES		CZ	1. Konformitetserklæring iht. trykbeholderdirektivet 97/23/CE		DA			
2. Tlaková nádoba	Osvědčení č. HYDAC č.		2. Tlaková nádoba	Osvědčení č. Čís. zakázky HYDAC		2. Trykbeholder	Certifikat nr. HYDAC nr.				
3. Popis	Počet kusů		3. Popis	Počet kusů		3. Tegnelse	Antal				
4. Typ	Č. produktu		4. Typ	Čís. výrobku		4. Type	Materiale nr.	Produktionsår			
5. Č. série	Rok výroby		5. Čís. série	Rok výroby		5. Serie nr.					
6. Výkres č. Index	Objem(V) L	Přídavek na korozi mm	6. Čís. výkresu	Znak	Obsah (V)	6. Tegnings nr. Revision	Volumen (V) L	Korrosionsstillæg mm			
7. Výpočtový přetlak (PD) bar	Výpočtová teplota (TD) °C		7. Projektovaný tlak (PD) bar	Projektovaná teplota (TD) °C		7. Design tryk (PD) bar	Design Temperatur (TD) °C				
8. Max. pracovní přetlak (PS) bar	min/max. pracovní teplota (TS) °C		8. Maximální přípustný tlak (PS) bar	Přípustná minimální/maximální teplota (TS) °C		8. Max.Tilladeligt arbejdstryk (PS) bar	min/maxTilladeligt arbejdstemperatur (TS) °C				
9. Zkušební tlak (PT) bar	Kategorie	Použitý modul	9. Zkušební tlak (PT) bar	Kategorie	Použité moduly	9. Test tryk (PT) bar	Kategori	Anvendte moduler			
10. Pracovní látka			10. Provozní medium			10. Trykmedie					
11. Zkušební místo pro	☐ Typová zkouška	☐ Stavební zkouška	11. Zkušebna pro	☐ Zkoušení koncepce	☐ Zkoušení typu	11. Inspektør for	☐ design-godkendelse	☐ og type-godkendelse			
12. Jméno	Adresa		12. Název	Adresa		12. Navn	Adresse				
13. Identifikační č.	Certifikát č.	Datum	13. Identifikační číslo	Čís. certifikátu	Datum	13. Materiale nr.	Certifikat nr.	Dato			
14. Zkušební místo pro výrobu, zkoušky a dokumentaci	Adresa		14. Zkušebna pro přejímku (závěrečná zkouška a tlaková zkouška)			14. Inspektør for Afsluttende verifikation (Afsluttende undersøgelse og Trykproevning)					
15. Jméno	Adresa		15. Název	Adresa		15. Navn	Adresse				
16. Identifikační č.	Certifikát č.	Datum	16. Identifikační číslo	Čís. certifikátu	Datum	16. Materiale nr.	Certifikat nr.	Dato			
17. Zkušební místo pro certifikaci QM - systému	Adresa		17. Zkušebna pro certifikaci systému QM			17. Inspektør for evaluering af kvalitets-sikringssystem					
18. Jméno	Adresa		18. Název	Adresa		18. Navn	Adresse				
19. Identifikační č.	Certifikát č.	Datum	19. Identifikační číslo	Čís. certifikátu	Datum	19. Materiale nr.	Certifikat nr.	Dato			
20. Firma Hydac Technology GmbH prohlašuje, že konstrukce, výroba, zkoušky a dokumentace této tlakové nádoby (těchto tlakových nádob) odpovídá požadavkům zavedených norem.			20. Výrobce, HYDAC Technology GmbH, potvrzuje, že konstrukce, výroba a zkoušení této tlakové nádoby (těchto tlakových nádob) splňuje požadavky směrnice EU o tlakových nádobách 97/23/ES.			20. HYDAC Technology GmbH certifikat for, design, fremstilling, inspektion og dokumentation af denne/disse trykbeholder(e) i henhold til de anvendte standarder.					
21. Použité normy			21. Uplatněné normy a technické specifikace:			21. Anvendt standard					
22. Poznámky			22. Poznámky			22. Bemærkninger					
23. Datum	Pozice	Jméno	23. Datum	Funkce	Jméno	23. Dato	Position	Navn			
24. Razítko výrobce			24. Razítko výrobní firmy			24. Producent stempel					
25. Přílohy		Podpis	25. Přílohy		Podpis	25. Bilag		Underskrevet			
1. KONFORMITÄTSEKLRUNG nach Druckgeräterichtlinie 97/23/EG			DE	1. ΔΗΛΩΣΗ ΣΥΜΜΟΡΦΩΣΗΣ βάσει ντερεκτιβίας μηχανών πίεσης 97/23/ΕΟΚ			EL	1. DECLARATION OF CONFORMITY according to Pressure Equipment Directive 97/23/EC			EN
2. Druckbehälter	Bescheinigung Nr. HYDAC Auftrag-Nr.		2. Δεξαμενή πίεσης	No. Βεβαίωσης No. HYDAC		2. Pressure vessel	Certificate no. HYDAC Order no.				
3. Beschreibung	Stückzahl		3. Περιγραφή	Τεμάχια		3. Description	Quantity				
4. Typ	Artikel-Nr.	Baujahr	4. Μοντέλο	No. είδους		4. Type	Stock no.	Year of manufacture			
5. Seriennummer			5. Σειριακός αριθμός	Ετος κατασκευής		5. Serial no.					
6. Zeichnungs-Nr. Index	Rauminhalt (V) L	Korrosionszuschlag mm	6. No. σχεδίου	Όγκος (V) L	Διαβρωτική προστασία mm	6. Drawing no. Index	Volume (V) Litre	Corrosion allowance mm			
7. Auslegungsdruk (PD) bar	Auslegungstemperatur (TD) °C		7. Κατασκευαστική πίεση (PD) bar	Κατασκευαστική θερμοκρασία (TD) °C		7. Design Pressure (PD) bar	Design Temperature (TD) °C				
8. Maximal zulässiger Druck (PS) bar	Zuässige minimale/maximale Temperatur (TS) °C		8. Επιτρ. υπερπίεση (PS) bar	Επιτρ. θερμοκρασία λειτουργίας (TS) °C		8. Max Permissible Operating Pressure (PS) bar	min/max Permissible Operating Temperature (TS) °C				
9. Prüfdruck (PT) bar	Kategorie	Verwendete Module	9. Πίεση test (PT) bar	Κατηγορία	Χρησιμοποιηθέντα μοντούλ	9. Test Pressure (PT) bar	Category	Modules followed			
10. Betriebsmedium			10. Υλ./μέσον λειτουργίας			10. Operating Fluid					
11. Prüfstelle für	☐ Entwurfsprüfung	☐ Baumusterprüfung	11. Υπηρεσία ελέγχου για	☐ Ελεγχος σχεδίου	☐ Ελεγχος σχεδίου	11. Inspection Authority for	☐ Design Approval	☐ Type Approval			
12. Name	Adresse		12. Ονομα	Διεύθυνση		12. Name	Address				
13. Kenn.-Nr.	Zertifikat-Nr.	Datum	13. Διακριτικός αριθμός	No. Πιστοποιητικού	Ημερομηνία	13. Ident. No.	Certificate no.	Date			
14. Prüfstelle für die Abnahme (Schlussprüfung und Druckprüfung)	Adresse		14. Υπηρεσία ελέγχου κατασκευής, ελέγχου και τεκμηρίωσης			14. Inspection Authority for final assessment (Final inspection and Proof test)					
15. Name	Adresse		15. Ονομα	Διεύθυνση		15. Name	Address				
16. Kenn.-Nr.	Zertifikat-Nr.	Datum	16. Διακριτικός αριθμός	No. Πιστοποιητικού	Ημερομηνία	16. Ident. No.	Certificate no.	Date			
17. Prüfstelle für die Zertifizierung des QM-Systems	Adresse		17. Υπηρεσία ελέγχου πιστοποίησης του συστήματος μόνιτων ποιότητας			17. Inspection Authority for the certification of the Quality System					
18. Name	Adresse		18. Ονομα	Διεύθυνση		18. Name	Address				
19. Kenn.-Nr.	Zertifikat-Nr.	Datum	19. Διακριτικός αριθμός	No. Πιστοποιητικού	Ημερομηνία	19. Ident. No.	Certificate no.	Date			
20. Der Hersteller, HYDAC Technology GmbH, bescheinigt, daß Konstruktion, Herstellung und Prüfung dieser (dieser) Druckbehälter(s) den Anforderungen der EG-Druckgeräterichtlinie 97/23/EG erfüllen.			20. Η εταιρία HYDAC Τεχνολογίας Ε.Π.Ε. βεβαιώνει ότι, ο σχεδιασμός, η κατασκευή, ο έλεγχος και η τεκμηρίωση της/των δεξαμενής/ών πίεσης ανταποκρίνεται/ονται στις απαιτήσεις των εφαρμοστέων προδιαγραφών.			20. The manufacturer, HYDAC Technology GmbH, certifies that the Design, Manufacture and inspection of this (these) Pressure Vessel(s) comply with the requirements of the Directive 97/23/EC.					
21. Angewandte Normen und techn. Spezifikationen			21. Εφαρμοστές προδιαγραφές			21. Standards and tech. Specifications used					
22. Bemerkungen			22. Σημειώσεις			22. Remarks					
23. Datum	Position	Name	23. Ημερομηνία	Βαθμός	Όνομα	23. Date	Position	Name			
24. Stempel der Herstellerfirma			24. Σφραγίδα κατασκευαστικής εταιρίας			24. Manufacturer's Stamp					
25. Anlagen		Unterschrift	25. Εσώκλειστα	Υπογραφή		25. Attachments				Signature	
1. DECLARACIÓN DE CONFORMIDAD de acuerdo a la Directiva 97/23/CE para Aparatos a Presión.			ES	1. Paineiläitedirektiivin 97/23/EY mukainen VAATIMUSTENMUKAISUUSVAKUUTUS			FI	1. DECLARATION DE CONFORMITÉ suivant la Directive des Equipements sous Pression 97/23/CE			FR
2. Aparatos a presión	No. de Certificado No. HYDAC		2. Paineilaitte	Todistusnumero HYDAC numero		2. Récipient sous pression	N° du Certificat N° contrat HYDAC				
3. Descripción	Cantidad		3. Kuvaus	Määrä		3. Description	Quantité				
4. Tipo	No. de material	Año de fabricación	4. Tyypit	Artikkelinumero	Valmistusvuosi	4. Type	Code Article	Année de Fabrication			
5. No. de fabricación			5. Sarjanumero			5. N° de Série					
6. No. del Dibujo	Index Volumen (V) L	Factor de corrosión mm	6. Piirustusunumero	Indeksi Tilavuus (V) l	Ohenemisvara mm	6. N° de Plan	Indice Volume (V) L	Surépaisseur de Corrosion mm			
7. Presión de diseño (PD) bar	Temperatura de diseño (TD) °C		7. Suunnittelupaine (PD) bar	Suunnittelulämpötila (TD) °C		7. Pression de Calcul (PD) bar	Temperature de Calcul (TD) °C				
8. Presión max. de servicio permitida (PS) bar	Temperatura min/max de servicio permitida (TS) °C		8. Max. Sallittu käyttöpain (PS) bar	min/maxSallittu käyttölämpötila (TS) °C		8. Pression max. de Service Admissible (PS) bar	Temperature min/max de Service Admissible (TS) °C				
9. Presión de ensayo (PT) bar	Categoría	Módul utilizado	9. Koepaine (PT) bar	Kategoria	Sovelletut moduulit	9. Pression d'Epreuve (PT) bar	Categorie	Module utilisé			
10. Fluido de servicio			10. Käyttöaine			10. Fluides admissibles en service					
11. Autoridad de Inspección para la	☐ aprobación del Diseño	☐ aprobación a tipo muestra	11. Vastaava tarkastuslaitos	☐ Suunnittelmataarkastus	☐ Tyypittarkastus	11. Organisme pour	☐ Approbation de Conception	☐ Approbation de Type			
12. Nombre	Dirección		12. Nimi	Osoite		12. Nom	Adresse				
13. No. de Ident.	No. de Certificado	Fecha	13. Tarkastuslaitoksen numero	Sertifikaattinumero	Päiväys	13. N° d'identification	N° de Certificat	Date			
14. Autoridad de Verificación final (Inspección final y Prueba)			14. Vastaava tarkastuslaitoksen Lopputarkastus (Loppukoe, Koeponnistus)			14. Organisme pour la Vérification finale (Examen final et Epreuve)					
15. Nombre	Dirección		15. Nimi	Osoite		15. Nom	Adresse				
16. No. de Ident.	No. de Certificado	Fecha	16. Tarkastuslaitoksen numero	Sertifikaattinumero	Päiväys	16. N° d'identification	N° de Certificat	Date			
17. Autoridad de Inspección para la evaluación del Sistema de Calidad			17. Laatujärjestelmän sertifioinnista vastaava tarkastuslaitos			17. Organisme pour l'évaluation du Système Qualité					
18. Nombre	Dirección		18. Nimi	Osoite		18. Nom	Adresse				
19. No. de Ident.	No. de Certificado	Fecha	19. Tarkastuslaitoksen numero	Sertifikaattinumero	Päiväys	19. N° d'identification	N° de Certificat	Date			
20. HYDAC Technology GmbH certifica que el diseño, la manufactura, la Inspección y la documentación de este(os) aparato(s) a presión cumplen con los requerimientos de las normas utilizadas.			20. HYDAC Technology GmbH vakuuttaa, että näiden paineestien rakenne, valmistus, tarkastus ja dokumentointi vastaavat sovellettavien standardien vaatimuksia.			20. Le fabricant, HYDAC Technology GmbH, certifie que, la Conception, la Fabrication et l'Inspection du(des) récipient(s) sont conformes aux exigences de la Directive 97/23/CE					
21. Normas utilizadas			21. Sovellettavat standardit			21. Normes et spécifications techniques utilisées					
22. Comentarios			22. Huomiot			22. Remarques					
23. echa	Posición	Nombre	23. Päiväys	Tehtävä yrityksessä	Nimi	23. Date	Position	Nom			
24. Sello de la Firma manufacturadora			24. Valmistajan leima			24. Cachet du Fabricant					
25. Apéndice		Signatura	25. Liitteet		Allekirjoitus	25. Documents joints		Signature			

Übersetzungen zur Konformitätserklärung nach Druckgeräterichtlinie 97/23/EG : Druckbehälter

Translations of the Declaration of Conformity acc. to Pressure Equipment Directive 97/23/CE : Pressure Vessel

Traductions de la Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CE : Réceptif sous pression

1. KONFORMITÁS NYILATKOZAT a 97/23/EG számú, nyomástartó edényekre vonatkozó irányelvek szerint	HU	1. DICHIARAZIONE DI CONFORMITA' secondo Pressure Equipment Directive 97/23/CE	IT	1. DECLARATION OF CONFORMITY acc. to Pressure Equipment Directive 97/23/CE	N
2. Nyomástartó edény Tanúsítvány száma: HYDAC száma 3. Megnevezés Darabszám 4. Típus Cikkszám 5. Sorozatszám Gyártási év 6. Rajtszám Index Térfogat (V) L Korrozíós-pótlék mm 7. Méretezési nyomás (PD) bar Méretezési hőmérséklet (TD) °C 8. Max. Megengedett üzemi nyomás (PS) bar min/max Megengedett üzemi hőmérséklet (TS) °C 9. Próbanyomás (PT) bar Kategória Alkalmazott modul 10. Üzemi folyadék 11. Vizsgálat helye Tervrajz vizsgálat Próbatervvizsgálat 12. Név Cím 13. Jelzőszám Bizonylatszám Dátum 14. Műszaki átvétel helye (végő vizsgálat és nyomáspróba) 15. Név Cím 16. Jelzőszám Bizonylatszám Dátum 17. A QM szerinti műbizonylat kiállításának helye 18. Név Cím 19. Jelzőszám Bizonylatszám Dátum 20. A HYDAC Technology GmbH ezennel igazolja, hogy a fenti nyomástartó edény(ek) konstrukciója, gyártása, vizsgálata és dokumentációja az alkalmazott normák követelményeinek megfelel. 21. Alkalmazott normák 22. Megjegyzések 23. Dátum Pozíció Név 24. A gyártó cég pecsétje Melléklet Aláírás	2. Recipiente a pressione Certificato no. HYDAC no. 3. Descrizione Quantità 4. Tipo Codice prodotto Anno di costruzione 5. Numero di serie 6. Disegno..Indice..Volume (V) L Sovrappessore di corrosione mm 7. Pressione di progetto (PD) bar Temperatura di progetto (TD) °C 8. Max. Pressione di lavoro ammessa (PS) bar min/max Temperatura di lavoro ammessa (TS) °C 9. Pressione di prova idrostatica(PT)bar Categoria Moduli applicati 10. Fluido di lavoro 11. Ente notificato per ☐ Approvazione del progetto ☐ Approvazione del tipo 12. Nome Indirizzo 13. Identificativo Certificato no. Data 14. Ente notificato per la Verifica finale (Esame finale e Prova) 15. Nome Indirizzo 16. Identificativo Certificato no. Data 17. Ente notificato per la valutazione del Sistema Qualità 18. Nome Indirizzo 19. Identificativo Certificato no. Data 20. HYDAC Technology GmbH certifica che progetto, costruzione, controllo e documentazione di questo/i recipienti/ a pressione sono conformi alle richieste delle Normative applicate. 21. Normativa 22. Note 23. Data Posizione Nome 24. Marcatura del costruttore Firma 25. Allegati	2. Trykk beholder Certificate no. HYDAC no. 3. Beskrivelse Antall 4. Type Material nr. År bygd 5. Serie nr. 6. Tegnings nr. Index Volum (V) L Korrosjon tillatt mm 7. Design trykk (PD) bar Design Temperatur (TD) °C 8. Max. Tillatt arbeids trykk (PS) bar min/max. Tillatt Arbeids Temperatur (TS) °C 9. Test trykk (PT) bar Kategori Module fulgt 10. Arbeids veske 11. Inspeksjons myndighet for ☐ Design godkjenning ☐ Type godkjenning 12. Navn Adresse 13. Ident. Nr. Sertifikat nr. Dato 14. Inspeksjons myndighet for produksjon, inspeksjon og dokumentasjon 15. Navn Adresse 16. Ident. Nr. Sertifikat nr. Dato 17. Inspeksjons myndighet for evaluering av kvalitet systemet 18. Navn Adresse 19. Ident. Nr. Sertifikat nr. Dato 20. HYDAC Technology GmbH Sertifiserer at, design, produksjon, inspeksjon og dokumentasjon av denne (disse) Trykk beholder(e) er i samsvar med kravene i brukt standard. 21. Standarder brukt 22. Bemerkninger 23. Dato Posisjon Navn 24. Produzentens stempel Signatur 25. Vedlegg			
1. VERKLARING VAN OVEREENSTEMMING volgens de richtlijn drukapparatuur 97/23/EG	NL	1. DEKLARACJA ZGODNOŚCI zgodnie z Wytyczną dla Urządzeń Ciśnieniowych 97/23/CE	PL	1. DECLARAÇÃO DE CONFORMIDADE conforme diretiva de vasos pressurizados 97/23/EG (CE)	PT
2. Drukvat Verklaring nr. HYDAC nr. 3. Beschrijving Aantal 4. Type Artikelnr. Bouwjaar 5. Serienummer 6. Tekeningnr. Index Volume (V) L Corrosietoeslag mm 7. Ontwerpdruk (PD) bar Ontwerptemperatuur (TD) °C 8. Max. Toegest. bedrijfsomdruk (PS) bar min/max. Toegest. bedrijfstemperatuur (TS) °C 9. Controledruk (PT) bar Gebruikte modules 10. Bedrijfsmedium 11. Controledienst voor ☐ Ontwerpkeuring ☐ Constructiekeuring 12. Naam Adres 13. Referentienr. Certificaatnr. Datum 14. Keuringsdienst voor Eindcontrole (Eindinspectie en Beproeving) 15. Naam Adres 16. Referentienr. Certificaatnr. Datum 17. Keuringsdienst voor de certificering van het QM-systeem 18. Naam Adres 19. Referentienr. Certificaatnr. Datum 20. De firma HYDAC Technology GmbH verklaart dat de constructie, fabricage, keuring en documentatie van dit (deze) drukvat(en) overeenkomt met de eisen van de toegepaste normen. 21. Toegepaste normen 22. Opmerkingen 23. Datum Positie Naam 24. Stempel van de fabrikant Handtekening 25. Bijlagen	2. Zbiornik ciśnieniowy Certyfikat nr. HYDAC nr. 3. Opis Ilość 4. Typ Nr artykułu Rok bud. 5. Nr fabr. 6. Rysunek nr Indeks Objętość (V) L Naddatek korozyjny mm 7. Ciśnienie obliczeniowe (PD) bar Temperatura obliczeniowa (TD) °C 8. Maks. ciśn. rob. (PS) bar min/Maks. temp. rob. (TS) °C 9. Ciśnienie próbne (PT) bar Kategoria Zastosowane moduły 10. Medium robocze 11. Urząd dozor dla ☐ Zatwierdzenia projektu ☐ Zatwierdzenia typu 12. Nazwa Adres 13. Nr ident. Certyfikat nr. Data 14. Urząd dozor dla produkcji, inspekcji i dokumentacji 15. Nazwa Adres 16. Nr ident. Certyfikat nr. Data 17. Urząd dozor dla certyfikacji systemu zapewnienia jakości 18. Nazwa Adres 19. Nr ident. Certyfikat nr. Data 20. Firma HYDAC Technology GmbH zaświadcza, że projekt, produkcja, kontrola i dokumentacja tego (tych) zbiornika(-ów) ciśnieniowego(-ych) zgodna jest z wymogami zastosowanych norm. 21. Zastosowana norma 22. Uwagi 23. Data Pozycja Nazwa 24. Stempel producenta Podpis 25. Załącznik	2. Vaso de pressão Certificado N° HYDAC N° 3. Descrição Quantidade 4. Tipo Artigo N° Ano de fabr. 5. N° de série 6. N° de desenho Index Volume (V) L Acréscimo de corrosão mm 7. Pressão de projeto (PD) bar Temperatura de projeto (TD) °C 8. Max. Pressão operacional permissível (PS) bar min/max. Temperatura operacional permissível (TS) °C 9. Pressão de exame (PT) bar Categoria Módulos utilizados 10. Fluidos operacionais 11. Autoridade de exame para ☐ Exame de projeto ☐ Exame de amostra construtiva 12. Nome Endereço 13. N° de identif. N° do certificado Data 14. Autoridade de exame para Verificação final (Exame final e Ensaio) 15. Nome Endereço 16. N° de identif. N° do certificado Data 17. Autoridade de exame para a certificação do sistema QM 18. Name Endereço 19. N° de identif. N° do certificado Data 20. A Firma HYDAC Technology GmbH certifica que o projeto, a fabricação, o exame e a documentação deste (destes) reservatório(s) de pressão corresponde (m) às exigências das Normas aplicadas. 21. Normas utilizadas 22. Observações 23. Data Posição Nome 24. Carimbo do fabricante Assinatura 25. Anexos			
1. СЕРТИФИКАТ СООТВЕТСТВИЯ согласно Directive для напорных сосудов 97/23/CE	RUS	1. IZJAVA O SKLADNOSTI z Direktivo o tlačni opremi 97/23/EC	SL	1. FÖRSÄKRAN OM ÖVERENSSTÄMMELSE enligt Tryckkärlsdirektivet 97/23/EG	SV
2. Напорный сосуд Свидетельство № HYDAC № 3. Описание Количество 4. Тип Артикул № Год выпуска 5. Серийный номер 6. Чертеж № Индекс Объем (V) л Припуск на коррозию мм 7. Расчетное давление (PD) бар Расчетная температура (TD) °C 8. Допуст. рабочее давление (PS) бар Допуст. рабочая температура (TS) °C 9. Контрольное давление (PT) бар Категория Используемый модуль 10. Рабочая жидкость 11. Орган контроля для ☐ утверждения проектов ☐ утверждения типов 12. Ф.И.О. Адрес 13. Идентификационный № Сертификат № Дата 14. Орган контроля для производства, контроля и документации 15. Ф.И.О. Адрес 16. Идентификационный № Сертификат № Дата 17. Орган контроля для сертификации систем управления качеством 18. Ф.И.О. Адрес 19. Идентификационный № Сертификат № Дата 20. Фирма HYDAC Technology GmbH удостоверяет, что конструкция, производство, контроль и документация этих (этого) напорных сосудов соответствует требованиям использованных норм. 21. Исползованные нормы 22. Примечание 23. Дата Должность Ф.И.О. 24. Печать производителя Подпись 25. Приложения	2. Tlačna posoda Številka certifikata: Številka HYDAC 3. Opis Količina 4. Tip Skladiščna št. Leto izdelave 5. Serijska številka 6. Št. Risbe Indeks Volumen (V) Litri Dodatek za korozijo mm 7. Projektirani tlak (PD) bar Projektirana temperatura (TD) °C 8. Max. Dovoljen delovni tlak (PS) bar min/max. Dovoljena delovna temperatura (TS) °C 9. Preizkusni tlak (PT) bar Kategorija Uporabljeni moduli 10. Delovni medij 11. Kontrolno mesto za ☐ Presajo projekta ☐ Presajo vzorca 12. Ime Naslov 13. Identifikacijska št. Št. certifikata Datum 14. Kontrolno mesto za prevzem (dokončna kontrola in tlačni preizkus) 15. Ime Naslov 16. Identifikacijska št. Št. certifikata Datum 17. Kontrolno mesto za certificiranje sistema kvalitete 18. Ime Naslov 19. Identifikacijska št. Št. certifikata Datum 20. Podjetje HYDAC Technology GmbH potrjuje, da konstrukcija, proizvodnja, kontrola in dokumentacija te tlačne posode ustreza uporabljenim standardom. 21. Uporabljeni standardi 22. Opombe 23. Datum Služba Ime 24. Žig proizvajalca Podpis 25. Priloge	2. Tryckkärl Intyg nr. HYDAC nr. 3. Beskrivning Antal 4. Typ Artikel nr. Tillverkningsår 5. Serie nr. 6. Ritning nr. Index Volym (V) L Korrosionstillägg mm 7. Konstruktionstryck (PD) bar Konstruktionstemperatur (TD) °C 8. Max. Tillåtet arbetstryck (PS) bar min/max. Tillåten arbetstemperatur (TS) °C 9. Provtryck (PT) bar Kategori Använd modul 10. Arbetsfluid 11. Anmält organ för ☐ Konstruktionskontroll ☐ Typkontroll 12. Namn Adress 13. Ident. nr. Intyg nr. Datum 14. Anmält organ för Slutkontroll (Slutlig undersökning och Tryckkontroll) 15. Namn Adress 16. Ident. nr. Intyg nr. Datum 17. Anmält organ för kontroll av tillverkarens kvalitetssystem 18. Namn Adress 19. Ident. nr. Intyg nr. Datum 20. HYDAC Technology GmbH intygar att konstruktion, tillverkning, kontroll och dokumentation av detta (dessa) tryckkärl överensstämmer med kraven i angiven föreskrift. 21. Använd föreskrift 22. Påpekande 23. Datum Befattning Namn 24. Tillverkarens stämpel Underskrift 25. Bilagor			

Bestätigung

Die Zertifizierungsstelle für QS-Systeme nach DGRL 97/23/EG der SGS-TÜV GmbH – ein Unternehmen der SGS-Gruppe und des TÜV Saarland e.V. - bestätigt, dass sich die Kenn-Nummer der Benannten Stelle mit Übergang der Zulassung vom TÜV Saarland e.V. auf die SGS-TÜV GmbH von der 0034 auf die 1637 geändert hat. Dies gilt seit 01.04.2009.

Die Zertifizierungsstelle für QS-Systeme (Benannte Stelle mit der Kenn-Nr. 1637) akzeptiert als Nachfolgeorganisation des TÜV Saarland e.V. (Benannte Stelle mit der Kenn-Nr. 0034) für eine Übergangszeit mit der Laufzeit des Zertifikates (Zertifikat-Nr. 71 202 A 001) die Verwendung der Kennzeichnung der Produkte mit der Kenn-Nr. 0034 zusammen mit der Konformitätserklärung nach DGRL 97/23/EG Modul H1. Die Konformitätsbewertung unter der Kenn-Nr. 1637 muss den Verweis auf die Kennzeichnung des Produktes mit 0034 beinhalten.

Für weitere Fragen stehen Ihnen Herr Dr. Brendel (0170 7634043) und Herr Dietz (0174 3009138) gerne zur Verfügung.

Confirmation

The Certification Body for QS Systems based on the standard PED 97/23/EG of the SGS-TÜV GmbH, a company belonging to the SGS group and the TÜV Saarland e.V., hereby confirms that the no. of the Notified Body changed from 0034 to 1637 as the accreditation was passed from the TÜV Saarland e.V. on to the SGS-TÜV GmbH, with date of 01.04.2009.

The Certification Body for QS Systems (that is to say, the Notified Body no. 1637, the successor organization of the TÜV Saarland e.V. which was the Notified Body before with no. 0034, as indicated above) is disposed to accept that during the remaining time of validity of the certificate no. 71 202 A 001 the products can get labelled with the number 0034, but need to be accompanied by a declaration of conformity based on PED 97/23/EG module H1. It is required that the evaluation of conformity carried out by no. 1637 does contain a reference to the product labelling with number 0034.

For any further questions in this regard, please feel free to contact Mr. Brendel (mobile: 0170-7634043) or Mr. Dietz (mobile: 0174-3009138).

Attestation

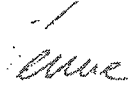
L'Office de certification des Systèmes Assurance Qualité selon la Directive équipements sous pression 97/23/EG de SGS-TÜV GmbH - une société du groupe SGS et du TÜV Saarland e.V. - atteste que le n° de marquage de l'organisme notifié a été modifié de 0034 à 1637, suite à la transition de l'accréditation de TÜV Saarland e.V. à SGS-TÜV GmbH, ceci à partir du 01.04.2009.

L'Office de certification des Systèmes Assurance Qualité (organisme notifié avec le n° 1637) accepte, à titre d'organisme successeur du TÜV Saarland E.V. (organisme notifié avec le n° 0034) pour une période transitoire de la durée du certificat (certificat n° 71 202 A 001), l'utilisation du marquage des produits avec le n° 0034 conjointement avec une attestation de conformité selon Directive 97/23/EG module H1. L'évaluation de la conformité sous le n° 1637 doit contenir la référence du marquage du produit 0034.

Pour tout renseignement complémentaire, veuillez vous adresser à M. Brendel (+49 170 7634043) ou M. Dietz (+49 174 3009138).

Sulzbach, 07.04.2010


i.V. Dr. Wolfgang Brendel
Leiter Zertifizierungsstelle für QS-Systeme


i.A. Dr. Hagen Senne
QMB SGS-TÜV GmbH

1. Allgemeine Hinweise

1.1 Zielgruppen

Diese Betriebsanleitung richtet sich an Fachpersonal.

Dieses Personal

- ist für den Einbau des Speichersicherheitsventils geschult,
- kennt die allgemeine Sicherheitshinweise im Zusammenhang mit der Bedienung und Wartung der Maschine, wo das Ventil eingebaut wird,

- kennt den Inhalt dieser Betriebsanleitung

2 Geräte- Beschreibung

2.1 Bestimmungsgemäße Verwendung

Das Speichersicherheitsventil ist ausschließlich dazu bestimmt:

- zur Absicherung des Hydraulikspeichers gegen Drucküberschreitung

Für andere als die hier aufgeführten Verwendungsarten ist das Speichersicherheitsventil nicht bestimmt. Das gilt als sachwidrige Verwendung!

2.2 Aufbau

- siehe HS- Druckschrift 7501406.05.03.96

2.3 Funktion

- siehe HS- Druckschrift 7501406.05.03.96

2.4 Technische Daten

- siehe HS- Druckschrift 7501406.05.03.96

3 Allgemeine Sicherheitshinweise

3.1 Sorgfaltspflicht des Betreibers

Das Speichersicherheitsventil wurde unter Berücksichtigung einer Gefährdungsanalyse und nach sorgfältiger Auswahl der einzuhaltenden harmonisierten Normen, sowie weiterer technischer Spezifikationen konstruiert und gebaut. Es entspricht damit dem Stand der Technik und gewährleistet ein Höchstmaß an Sicherheit.

Diese Sicherheit kann in der betrieblichen Praxis jedoch nur dann erreicht werden, wenn alle dafür erforderlichen Maßnahmen getroffen werden. Es unterliegt der Sorgfaltspflicht des Betreibers, diese Maßnahmen zu planen und ihre Ausführung zu kontrollieren.

Der Betreiber muß insbesondere sicherstellen, daß

- das Speichersicherheitsventil nur bestimmungsgemäß verwendet wird (vgl. hierzu Kapitel Produktbeschreibung),
- das Speichersicherheitsventil nur in einwandfreiem, funktionsfähigem Zustand betrieben wird,
- erforderliche persönliche Schutzmaßnahmen für das Bedienpersonal zur Verfügung stehen und benutzt werden,
- die Betriebsanleitung stets in einem leserlichen Zustand und vollständig zur Verfügung steht,
- das Ventil wird nur vom ausreichend qualifizierten und autorisierten Personal eingebaut und gewartet
- dieses Personal regelmäßig in allen zutreffenden Fragen von Arbeitssicherheit und Umweltschutz unterwiesen wird, sowie die Betriebsanleitung und insbesondere die darin enthaltenen Sicherheitshinweise kennt,

Technische Dokumentation
für
Speichersicherheitsventile

HERION Systemtechnik GmbH
Postfach 1269
71256 Weil der Stadt
Tel. 07033/3018-0
Fax 07033/3018-10

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3. Allgemeine Sicherheitshinweise
 - 3.1 Sorgfaltspflicht des Betreibers
 - 3.2 Verwendete Sicherheitssymbole
 - 3.3 Starten
 - 3.4 Normalbetrieb
 - 3.5 Hydraulik
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 - 6.1 Allgemeine Hinweise
 - 6.2 Sicherheitshinweise zur Wartung und Instandhaltung
 - 6.3 Wartungsintervalle
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 - 6.5 Allgemeine Hinweise zur Instandsetzung
 - 6.6 Hilfsmittel
7. Anhang
 - 7.1 EG-Konformitätserklärung
 - 7.2 Datenblatt-Speichersicherheitsventil

- alle am Speichersicherheitsventil angebrachten Sicherheits- und Warnhinweise nicht entfernen und lesbar bleiben,
- das Bedienungspersonal über das Verhalten bei Störfällen geschult wird.

3.2 Verwendete Sicherheits Symbole

In der vorliegenden Betriebsanleitung werden die folgenden Sicherheits Symbole verwendet. Diese Symbole sollen den Leser vor allem auf den Text des nebenstehenden Sicherheitshinweises aufmerksam machen.



Gefahr!

Dieses Symbol weist darauf hin, daß Gefahren für Leben und Gesundheit von Personen bestehen.



Achtung!

Dieses Symbol weist darauf hin, daß Gefahren für Maschine, Material oder Umwelt bestehen.



Hinweis!

Dieses Symbol kennzeichnet Informationen, die zum besseren Verständnis der Bedienungsabläufe beitragen

3.3 Starten

Vor jedem Start sind folgende Tätigkeiten durchzuführen:

- das Speichersicherheitsventil auf sichtbare Schäden überprüfen; festgestellte Mängel dem Aufsichtspersonal melden - das Speichersicherheitsventil darf nur in einwandfreiem Zustand betrieben werden,
- Alle Gegenstände und sonstigen Materialien, die nicht für den Betrieb benötigt werden, sind aus dem Arbeitsbereich des Speichersicherheitsventils zu entfernen.

3.4 Normalbetrieb

- Während des Betriebes des Speichersicherheitsventils dürfen keine Sicherheitsvorrichtungen entfernt oder außer Funktion gesetzt werden,
- Das Bedienungspersonal hat darauf zu achten, daß sich keine unbefugten Personen im Arbeitsbereich des Speichersicherheitsventils aufhalten,
- Einmal täglich sind folgende Kontrolltätigkeiten auszuführen:
 - das Speichersicherheitsventil auf äußerlich erkennbare Schäden und auf Dichtheit überprüfen

3.5 Hydraulik

Umgang mit Hydrauliköl

Bei Arbeiten an der Speichereinrichtung besteht die Gefahr, daß Flüssigkeit unter hohem Druck heraus spritzen kann.



- Augenschutz: Beim Einsatz geeignete Schutzbrille tragen!
 - Dampf und Nebel nicht einatmen!
 - Hautkontakt: Schutzhandschuhe tragen
 - Einnahme: Nahrungsmittel fernhalten!
- Nicht am Arbeitsplatz essen!



- Verspritztes Hydrauliköl sofort aufsaugen!
- Geeignetes Schutzwerk tragen! Rutschgefahr!
- Hautkontakt: Schutzhandschuhe tragen

Maßnahmen bei Unfällen:

- Augenkontakt
Augen mindestens 15 Minuten lang mit Wasser spülen
- Hautkontakt
Haut mit Wasser und Seife abwaschen
- Einnahme
Kleidung waschen
- Kein Erbrechen auslösen, sondern Arzt aufsuchen

Gefahr!



Hinweis!

3.6 Umweltschutz

Bei allen Arbeiten am Speichersicherheitsventil sind die Vorschriften zur Abfallvermeidung und zur ordnungsgemäßen Abfallverwertung bzw. -Beseitigung einzuhalten.

3.7 Veränderungen am Speichersicherheitsventil

Am Speichersicherheitsventil dürfen aus Sicherheitsgründen keine eigenmächtigen Veränderungen vorgenommen werden. Alle geplanten Veränderungen müssen von der Firma Herion-Systemtechnik schriftlich genehmigt werden.

3.8 Thermische Gefährdungen



- Bei Arbeiten am Ventil besteht die Gefahr von Verbrennungen durch
 - Kontakt mit heißem Hydrauliköl
 - Kontakt mit erwärmtem Gerät

4. Inbetriebnahme

4.1 Allgemeine Hinweise

Einbaubuchung: siehe HS- Druckschrift 7501406

5. Hilfe bei Störungen

5.1 Allgemeine Hinweise

Bedienpersonal benachrichtigen

6. Wartung und Instandhaltung

6.1 Allgemeine Hinweise

6.1.1 Hydraulik- Inspektion

Bei Speichersicherheitsventilen ist die Ansprechfähigkeit, in der Öl abgeführt wird für die Lebensdauer bestimmend. Diese Zeit ist im allgemeinen schwer zu bestimmen. Auf der sicheren Seite ist man hierbei, wenn nach ca. 30 Anschreibungsverhalten oder max. nach 5 Jahren die Ventile auf Dichtheit überprüft werden.

6.1.2 Kontrolle des Zustandes des Speichersicherheitsventils

Die Einstellung auf den Maximaldruck erfolgt im Werk. Gegen unbefugtes Verstellen auf einen anderen Druck wird die Abdeckhaube plombiert. Es wird regelmäßig kontrolliert, ob das nicht beschädigt oder entfernt ist.

6.1.3 Fristen

Vorgeschriebene oder in Betriebsanleitung angegebene Fristen für wiederkehrende Prüfungen/Inspektionen einhalten!

6.1.4 Werkstattaufrüstung

Zur Durchführung von Instandhaltungsmaßnahmen ist eine den Arbeiten angemessene Werkstattaufrüstung unbedingt notwendig.

6.2 Sicherheitshinweise zur Wartung und Instandhaltung

- kpl. Anlage auf Zimmertemperatur abkühlen
- Anlage muß drucklos sein.



Gefahr!

Vor Öffnung von Anschlüssen: Möglichkeit zum Auffangen des Hydrauliköls schaffen



Achtung!



Gefahr!

Plomben an Geräten dürfen nicht entfernt werden.

6.3 Wartungsintervalle

Hinweis: Die Zeitintervalle sind Vorschläge, die sich je nach Betriebsbedingungen ändern können.

Lfd. Nr. Durchzuführende Arbeiten Zeitintervall

- | Lfd. Nr. | Durchzuführende Arbeiten | Zeitintervall |
|----------|---|---------------|
| 1. | Geräte auf Beschädigung und Dichtheit kontrollieren | wöchentlich |

6.4 Druck- Kontrollen



Achtung!

- Auf ungewöhnliche Druckschwankungen achten.
- Auf abweichende Anzeigen gegenüber den Einheitswerten achten.

6.5 Allgemeine Hinweise zur Instandsetzung

6.5.1 Dokumentationsunterlagen für Instandsetzungsarbeiten:

Siehe unter

Punkt 7.2 Teile- Dokumentation

6.5.2 Allgemeine Sicherheitshinweise zur Instandsetzung

- Allgemeine Sicherheitshinweise gemäß 6.2 beachten!

• Vermeidung von Umweltschäden durch Mineralöl

Hinweis: Das Gerät ist während der Inbetriebnahme und in regelmäßigen Abständen auf Dichtheit zu überprüfen.

Achtung! Eventuell anfallendes Aböl bei Reparaturen muß in geeigneten Behältern aufgefangen werden.

Für sichere und umweltchonende Entsorgung von Betriebs- und Hilfsstoffen sowie Austauschteilen sorgen!

6.5.3 Demontage und Wiedermontage

- Vor Demontagearbeiten ist die Anlage grundsätzlich entspannungsfrei zu schalten.
- Montagearbeiten an den Geräten dürfen erst nach Ablassen des Flüssigkeitsdruckes und des Flüssigkeitsvolumens durchgeführt werden.
- Es dürfen keine Geräte gelöst werden, solange das System unter Druck steht.
- Bei allen Arbeiten ist auf größte Sauberkeit der Umgebung zu achten.
- Jede Öffnung ist mit Schutzkappen zu versehen.
- Zum Reinigen kein Putzmittel verwenden.
- Beim Abwaschen mit Lösungsmitteln darf nicht in das Innere des Systems gelangen.
- Keine mechanischen Bearbeitungen am System durchführen, bei der Späße in das Innere gelangen können.

6.5.4 Hinweise zu kundenseitigen Reparaturen

Nach dem Demontieren von Speichersicherheitsventilen bzw. nach Wartungsarbeiten, bei denen Öl abgelassen wurde, müssen Maßnahmen für eine erneute Inbetriebnahme vorgenommen werden.



Achtung!

Erneute Inbetriebnahme
Diese Maßnahmen müssen sehr sorgfältig und nur von geschulten Personal durchgeführt werden. HS weist darauf hin, daß nach Eingriffen in das Gerät durch den Betreiber die Gewährleistung von HS erlischt

6.6 Maßmittel

Drehmomentrichtliniendat

Diese ist als Messmittel zu betrachten und unterliegt somit der Messmittelüberwachung des Betreibers.



**Systemtechnik
GmbH**

HERION Systemtechnik GmbH
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Untere Talstrasse 65, D-71263 Weil der Stadt
Tel.: +49 70 33 / 30 18-0 Fax: +49 70 33 / 30 18-10

Declaration of Conformity / Konformitätserklärung

in acc. to the pressure equipment directive 97/23/EC
nach Druckgeräterichtlinie 97/23/EG



type* Typ*	nominal size Nennweite	EC-type examination no. EG-Baumusterprüfnummer	type-test-no. Bauteilprüfnummer
DBC 6 HKE 017	6	01 202 2 046 02 60100	527
DBC 6 HKE 002	6	01 202 2 046 02 60100	942
DBC 6 XE 002	6	01 202 2 046 02 60100	942
DBC 10 HKE 017	10	01 202 2 046 02 60100	620

description of the pressure equipment / Beschreibung des Druckgerätes

* see name plate / siehe Typenschild

category IV

applied category in acc. to article 3 and annex II / angewandte Kategorie nach Artikel 3 und Anhang II

module / Modul	conformity assessment procedures / Konformitätsbewertungsverfahren	certificate number / Bescheinigungsnummer
B	EC type-examination / EG-Baumusterprüfung	01 202 2 046 02 60100
F	inspection of the products / Prüfung der Produkte	see conformity certificate / siehe Konformitätsbescheinigung

conformity assessment procedures in acc. to article 10 / angewandte Konformitätsbewertungsverfahren nach Artikel 10

module / Modul B: TÜV CERT - Zertifizierungsstelle für Druckgeräte des RWTÜV e. V.

identification number: 0044, Langemarckstraße 28, D-45141 Essen / Germany

name and address of the notified body (monitoring a.m. conformity assessment procedures)

Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

module / Modul F: TÜV CERT - Zertifizierungsstelle für Druckgeräte des TÜV-Süd Deutschland Bau und Betrieb GmbH

identification number: 0036, Gottlieb-Daimler-Str. 7, D-70794 Filderstadt / Germany

name and address of the notified body (monitoring a.m. conformity assessment procedures)

Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment is in accordance to the requirements of the pressure equipment directive.
Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entspricht.

at the moment no harmonized standards available

zur Zeit keine harmonisierten Normen verfügbar

applied harmonized standards / angewandte harmonisierte Normen

AD-Merkblatt 2000 A2, TRD 801 Nr. 45

other applied standards or technical rules / angewandte andere Normen oder technische Spezifikationen

25.02.02

date

Herion-Systemtechnik GmbH

Untere Talstr. 65, 71263 Weil der Stadt

manufacturer stamp

Th. Orenel



authorized subscriber

Sitz der Gesellschaft: Weil der Stadt - Registergericht: Amtsgericht Leonberg HRB 2734
Geschäftsführer: Hans-Jochen Efmert

ABN AMRO Bank Frankfurt
BLZ 502 304 00, Kto.-Nr. 18 09 166 004
SWIFT-Code: ARNAD333

Landesbank Baden-Württemberg
BLZ 600 501 01, Kto.-Nr. 222 44 06
SWIFT-Code: LBBW3333

Ein Unternehmen der IMI-Gruppe

IMI

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Hydrospeicher Betriebsvorschrift für Einbau und Wartung

Hydraulic Accumulator Fitting and Maintenance Instructions

Accumulateurs Hydrauliques Instructions de montage et d'entretien

Für Hydrospeicher sind die Aufstellungsort geltenden Vorschriften vor Inbetriebnahme und während des Betriebes zu beachten. In der Bundesrepublik Deutschland unterliegen diese der Druckbehälterverordnung (DruckbehV).

Am Speicherkörper dürfen weder Schweiß- noch Lötarbeiten und keinerlei mechanische Arbeiten vorgenommen werden. Arbeiten an Anlagen mit Speichern (Reparaturen, Anschließen von Manometern u. ä.) dürfen erst nach Ablassen der Druckflüssigkeit ausgeführt werden. Nach dem Anschließen der Hydraulikleitung ist diese vollständig zu entlüften.

Neue oder instandgesetzte Speicher müssen vor Inbetriebnahme mit Stickstoff aufgeladen werden.

Niemals Sauerstoff oder Luft verwenden! Explosionsgefahr! Wird der Speicher bereits mit dem gewünschten Gasfülldruck geliefert, so ist die Druckhöhe aus der Kennzeichnung zu ersehen. Gas- und Ölventilhaltemutter nach der Inbetriebnahme nachziehen (Anzugsdrehmoment lt. Reparaturanleitung verwenden). *

Defekte Gasventile dürfen nur durch original HYDAC-Teile ersetzt werden!

Grenzen des Gasfülldruckes und Betriebstemperatur beachten!

Warnhinweis:
Bedingt durch Permeation oder einen Defekt der Blase, der Membrane oder der Kolbendichtung tritt beim Füllen oder Prüfen des Speichers Stickstoff und Betriebsflüssigkeit aus.

ACHTUNG: Gesundheitsgefahr bei aggressiven Medien! (Sonderfüll- und Prüfvorrichtung auf Anfrage)

Warnhinweis:
Bedingt durch Permeation oder einen Defekt der Blase, der Membrane oder der Kolbendichtung kann sich Stickstoff in der Druckflüssigkeit lösen. Beim Entlasten auf niedrigeren Druck löst sich das Gas schlagartig aus der Flüssigkeit und dehnt sich dabei aus. Diese Tatsache ist bei der Auslegung von angeschlossen Bauteilen wie Tanks, Filter usw. zu beachten.

* gilt nur für Blasenpeicher

Prior to commissioning and during operation, the regulations relating to hydraulic accumulators which are in force in the country of installation must be adhered to.

In the Federal Republic of Germany, hydraulic accumulators are subject to the Pressure Vessels Regulations (DruckbehV).

On no account should welding, soldering or any mechanical work be carried out on the accumulator shell. Work on systems with accumulators (repairs, connection of pressure gauges etc.) should only be carried out once the pressure fluid has been drained out. Once the hydraulics have been connected, all air should be completely vented.

New or repaired accumulators must be charged with nitrogen prior to commissioning.

Never use oxygen or air! Danger of explosion!

If the accumulator is supplied already pre-charged with the required gas charging pressure, the pressure is marked.

After commissioning, tighten gas and oil valve lock nut (use torque given in repair instructions). *

Defective gas valves must only be replaced with original HYDAC parts! The limits of gas charging pressure and operating temperature must be taken into account.

Warning:

Due to permeation or a defect in the bladder, diaphragm or piston seal, nitrogen and operating fluid may escape when charging or testing the accumulator.

IMPORTANT: Health risks when aggressive media are used! (Special charging and testing unit available on request)

Warning:

Due to permeation or a defect in the bladder, diaphragm or piston seal, nitrogen can dissolve in the operating fluid. When releasing pressure, the gas is suddenly released from the fluid and expands.

This must be taken into account when sizing connected components such as tanks, filters etc.

* applies only to bladder accumulators

Les accumulateurs

hydrauliques sont soumis à la réglementation en vigueur au lieu d'installation et ceci avant et après leur mise en service. En France les appareils à pression de gaz sont soumis au Décret Ministériel du 18 janvier 1973, aux Arrêtés Ministériels du 05 janvier 1978, du 24 mars 1978 et du 24 novembre 1982.

Il est interdit d'effectuer des travaux de soudure, de brasure ou d'autres interventions mécaniques sur le corps de l'accumulateur.

Il est impératif de procéder à la vidange complète de l'accumulateur lors d'une intervention sur une installation. Le système hydraulique doit être intégralement purgé après raccordement à la tuyauterie.

Les accumulateurs neufs ou ceux remis en état doivent être remplis avec de l'azote avant leur mise en service.

Ne jamais utiliser d'oxygène ou d'air! Danger, risques d'explosion.

Lorsque l'accumulateur est livré avec la pression de gonflage souhaitée, celle-ci est mentionnée sur la plaque signalétique.

Resserrer l'écrou de maintien de la vessie et de la bouchette hydraulique après gonflage en azote de l'accumulateur (couples de serrage; voir notice de maintenance)

Les valves de gaz défectueuses doivent être remplacées par des pièces d'origine HYDAC.

Respecter les limites de pression de gonflage et de températures de service.

Avertissement:

En raison de la perméabilité de l'élastomère ou d'un défaut d'étanchéité de la vessie, de la membrane ou du piston, de l'azote et du fluide de service peuvent s'échapper lors du gonflage ou du contrôle de l'accumulateur.

ATTENTION: Dangers pour la santé avec les fluides agressifs! (Dispositif de gonflage et de contrôle spécial sur demande)

Avertissement:

En raison de la perméabilité de l'élastomère ou d'un défaut d'étanchéité de la vessie, de la membrane ou du piston, il est possible que de l'azote soit dissout dans le fluide sous pression. A la décharge, lorsque la pression est plus basse, le gaz s'échappe brusquement du fluide et se dilate à cette occasion. Cet état de fait doit être pris en compte lors de la détermination des réservoirs, des filtres etc...

* seulement pour des accumulateurs à vessie

Aufstellung, Ausrüstung und Betrieb von Hydrospeichern in der Bundesrepublik Deutschland werden durch die "Technischen Regeln Druckbehälter" (TRB) geregelt. Aus diesen geht hervor, daß folgende Sicherheits-einrichtungen und Ausrüstungen vorhanden sein müssen:

1. Sicherheitsventil gegen Drucküberschreitung
2. Manometer
3. Absperrventil
4. Entlastungsventil
5. Anschluß für Prüfmanometer

Diese sind platzsparend in einem HYDAC-Sicherheits- und Absperrblock zusammengefaßt. Zusätzlich sind lieferbar:

6. Elektromagnetisch betätigtes Entlastungsventil
7. Drossel
8. Sicherheitsventil gegen Temperaturüberschreitung

in the Federal Republic of Germany, the installation, equipping and operating of hydraulic accumulators is controlled by the "Technical Regulations with regard to Pressure Vessels" (TRB). These regulations specify that the following safety equipment must be fitted:

1. Safety valve to prevent excess pressure
2. Pressure gauge
3. Shut-off valve
4. Pressure drain valve
5. Connection for test gauge

These devices are combined in a compact, space-saving HYDAC safety and shut-off block. The following devices are additionally available:

6. Solenoid-operated relief device
7. Orifice
8. Safety valve to prevent excess temperatures

DE SYMBOLE

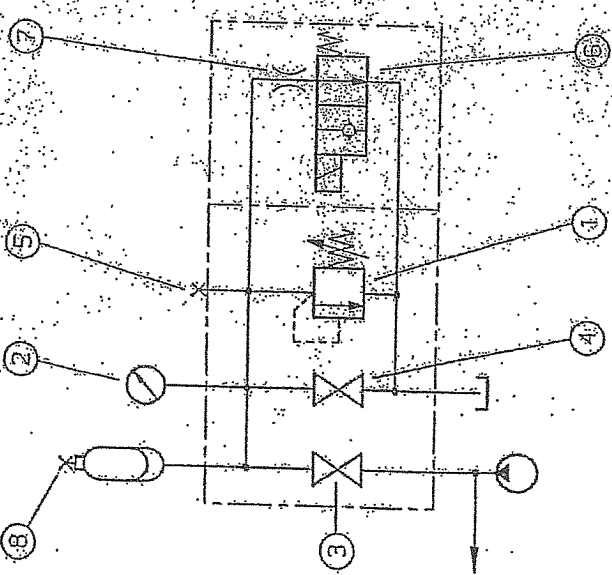
En Allemagne, l'installation et la mise en service des accumulateurs hydro-pneumatiques sont soumises aux règles du TRB (Technische Regeln für Druckbehälter). Les dispositions de sécurité et les équipements suivants sont obligatoires:

1. Limiteur de pression
2. Manomètre
3. Dispositif d'isolement
4. Dispositif de décharge manuelle
5. Prise de pression pour raccordement d'un manomètre de contrôle

Les blocs de sécurité HYDAC regroupent tous ces éléments dans une solution compacte

6. Electrovanne de décharge
7. Limiteur de débit
8. Fusible thermique en cas de surchauffe

Schaltplan eines HYDAC-Sicherheits- und Absperrblockes:
Circuit diagram of a HYDAC safety and shut-off block
Schéma d'un bloc de sécurité-HYDAC



GASFÜLLDRUCKES

1. PRÜFINTERVALLE
Nach Inbetriebnahme des Speichers soll der Gasfülldruck in der ersten Woche mindestens 1 mal geprüft werden. Wird kein Stickstoffverlust festgestellt, sollte eine weitere Prüfung nach ca. 4 Monaten erfolgen. Sollte auch dann keine Druckänderung eingetreten sein, ist eine jährliche Überprüfung des Gasfülldruckes ausreichend.

2. MESSEN DES GASFÜLLDRUCKES MIT MANOMETER AUF DER FLÜSSIGKEITSSEITE
Voraussetzung: Manometer ist an einer - mit dem Speicher in direkter Verbindung stehenden - Hydraulikleitung angeschlossen (gegebenenfalls Manometer am Entlastungsanschluß anbringen).
Vorgehensweise:

- Druckflüssigkeit in den Speicher füllen.
- Absperrventil ③ schließen.
- Durch Öffnen des Entlastungsventils ④ Druckflüssigkeit sehr langsam abfließen lassen (Temperaturausgleich). Handrad oder Hebel des Entlastungsventils nach links drehen, wobei der Hebel durch Anziehen umgesezt werden kann.

Während des Entlastungsvorganges Manometer ① ständig beobachten: Manometer fällt schlagartig auf Null! Zuletzt angezeigter Druck entspricht dem Gasfülldruck.

- Stimmt der Gasfülldruck nicht, so muß der Speicher nachgefüllt werden (siehe III.3.)

3. MESSEN DES GASFÜLLDRUCKES MIT HYDAC-FÜLL- UND PRÜFVORRICHTUNG

Siehe Bedienungsanleitung Füll- und Prüfvorrichtung. Servicestellen auf Anfrage. Weitere Informationen: Bedienungsanleitung Hydrospeicher Montage- und Reparaturanleitung

CHARGING PRESSURE

1. CHECKING INTERVALS
After commissioning the accumulator, the gas charging pressure should be checked at least once during the first week of operation. If no nitrogen loss is found, a further check should be carried out after approximately 4 months. If after this period no change in pressure is found, an annual check of the gas charging pressure will be sufficient.

2. MEASUREMENT OF GAS CHARGING PRESSURE USING PRESSURE GAUGE ON THE FLUID SIDE

Prerequisite: Pressure gauge is connected to a hydraulic line which is directly connected to the accumulator (if necessary, fit pressure gauge to the venting connection).
Procedure:

- Fill the accumulator with operating fluid.
- Close shut-off valve ③
- Discharge the fluid pressure very slowly by opening the drain valve ④ (temperature compensation).

To reposition hand lever on valve ④ pull out and turn anti-clockwise.

During the draining process, always observe the pressure gauge ②. The pressure indicated on the pressure gauge suddenly drops to zero! The last pressure indicated corresponds to the gas charging pressure. If the gas charging pressure is not correct, the accumulator must be re-charged (see III. 3.)

3. MEASUREMENT OF GAS CHARGING PRESSURE AND RE-CHARGING USING HYDAC CHARGING AND TESTING UNIT (FPU)

See operating instructions for charging and testing unit. Service agencies on request. Further information: Operating instructions for hydraulic accumulators. Instructions for assembly and repair.

III. CONTRÔLE DE LA PRESSION DE GONFLAGE

1. EXAMEN PÉRIODIQUE

Une vérification de la pression de gonflage est à effectuer pendant la première semaine après la mise en service de l'accumulateur. Si aucune perte d'azote n'est détectée, un autre contrôle est à prévoir après 4 mois. Si à la suite de ce deuxième contrôle la pression d'azote est restée inchangée, un contrôle annuel sera alors suffisant.

2. MESURE DE LA PRESSION AVEC UN MANOMÈTRE COTÉ FLUIDE

Condition: Le manomètre est monté sur une partie du circuit directement relié avec l'accumulateur (le cas échéant le manomètre doit être monté au niveau de la vis de purge).
Marche à suivre:

- Mettre l'accumulateur sous pression.
- Fermer la vanne d'isolement ③.
- Décharger lentement l'accumulateur en ouvrant la vanne ④ (compensation de la température). Tourner la molette ou le levier vers la gauche. La position initiale du levier peut-être modifiée en le tirant vers vous.

Durant le vidange, observer continuellement le manomètre ②. Le manomètre tombe brusquement à 0 ! La dernière pression indiquée correspond à la pression de gaz.

Si cette pression est insuffisante, il faut la corriger (voir III.3.)

3. MESURE DE LA PRESSION DE GONFLAGE AVEC HYDAC, DISPOSITIF DE GONFLAGE ET DE CONTRÔLE

Consultez le Mode d'emploi du dispositif de gonflage et de contrôle. Liste des Points Services sur demande. Informations complémentaires: voir Notice de montage et réparation pour accumulateurs hydro-pneumatiques.

0. Inhaltsverzeichnis

1. Gültigkeit
2. Funktionsbeschreibung
3. Sicherheitshinweise
4. Inbetriebnahme
5. Wartung und Instandhaltung

1. Gültigkeit

Vorliegende technische Dokumentation gilt für folgende hydraulische Robotergewichtsausgleiche:

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 1	0599.00.000/1	01-033-573
GA 1 – A	0617.00.000/1	01-034-571
GA 2 – D.1	0699.00.000/6	00-124-428
GA 2 – D.2	0699.00.000/7	71-040-031
GA 2 – K.1	0969.00.000/1	71-040-031
GA 2 – K.2	0969.00.000/2	71-040-031
GA 5	0734.00.000/1	00-100-278
GA 5.2	0734.00.000/3	00-118-267
GA 5.3	0734.00.000/4	00-118-267
GA 5-A	1103.00.000	00-167-918
GA 6	0752.00.000	00-100-797
GA 6.2	0752.00.000/2	00-118-268
GA 6.3	0752.00.000/3	00-118-268
GA 7	0862.00.000	00-120-082
GA 8	0879.00.000	01-040-047
GA 9	0966.00.000	00-139-944
GA 11	0999.00.000	00-147-094
GA 14	1144.00.000	00-183-637
GA 14-FO	1154.00.000	00-188-591
GA 15	1145.00.000	00-183-853
GA 16	1160.00.000	00-189-401
GA 17	1161.00.000	00-190-013

Die technische Dokumentation richtet sich an **ausgebildetes, qualifiziertes Fachpersonal**, das mit der Bedienung des Roboters, in dem der Gewichtsausgleich eingebaut wird, vertraut ist und die Sicherheitsbestimmungen in diesem Zusammenhang kennt.

2. Funktionsbeschreibung
2.1 Bestimmungsgemäße Verwendung

Es handelt sich bei diesen Baugruppen um ein geschlossenes hydraulisches System, das als Gewichtsausgleich für Industrieroboter (Achse 2) konzipiert und ausgelegt wurde. Folgende Typen wirken ziehend, d.h. der Stangenraum des Zylinders steht unter Druckvorspannung. Diese Typen sind für Industrieroboter mit Bodenbefestigung bestimmt.

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 1	0599.00.000/1	01-033-573
GA 1 – A	0617.00.000/1	01-034-571
GA 2 – D.1	0699.00.000/6	00-124-428
GA 2 – D.2	0699.00.000/7	71-040-031
GA 2 – K.1	0969.00.000/1	71-040-031
GA 2 – K.2	0969.00.000/2	71-040-031
GA 5	0734.00.000/1	00-100-278
GA 5.2	0734.00.000/3	00-118-267
GA 5.3	0734.00.000/4	00-118-267
GA 5-A	1103.00.000	00-167-918
GA 11	0999.00.000	00-147-094
GA 14	1144.00.000	00-183-637
GA 14-FO	1154.00.000	00-188-591
GA 16	1160.00.000	00-189-401

Diese Typen werden mit Öl- und Gasfüllung von der Fa. ÖLHYDRAULIK ALTENERDING ausgeliefert.

Folgende Typen wirken drückend, d.h. der Kolbenraum des Zylinders steht unter Druckvorspannung. Diese Typen sind für Industrieroboter mit Decken- oder Wandbefestigung bestimmt.

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 6	0752.00.000	00-100-797
GA 6.2	0752.00.000/2	00-118-268
GA 6.3	0752.00.000/3	00-118-268
GA 7	0862.00.000	00-120-082
GA 8	0879.00.000	01-040-047
GA 9	0966.00.000	00-139-944
GA 15	1145.00.000	00-183-853
GA 17	1161.00.000	00-190-013

Diese Typen werden nur mit Gasfüllung von der Fa. ÖLHYDRAULIK ALTENERDING ausgeliefert. Die Ölbefüllung wird vom Roboterhersteller durchgeführt.

Die Gewichtsausgleiche sind nur für die hier aufgeführten Verwendungen bestimmt. Andere Verwendungen sind nicht zulässig und gelten als sachwidrige Verwendung !

2.2 Technische Daten und Anschlussschema des Gewichtsausgleichs

Technische Daten siehe Konformitätserklärung MO-017.
Anschlussschema siehe Beschreibung der Baugruppe MO-018 unter Punkt 2 Anschlussschema.

Es sind ausschließlich die in der Beschreibung der Baugruppe MO-018 unter Punkt 3 aufgeführten Bestandteile zu verwenden.

3. Sicherheitshinweise

3.1 Sorgfaltspflicht des Betreibers

Der Gewichtsausgleich wurde unter Berücksichtigung einer Gefahrenanalyse konstruiert und hergestellt.

Die erforderlichen Maßnahmen zur Sicherheit in der betrieblichen Praxis unterliegen der Sorgfaltspflicht des Betreibers.

Der Betreiber muß insbesondere sicherstellen, dass

- der Gewichtsausgleich bestimmungsgemäß verwendet wird (siehe Punkt 2.1 der techn. Dokumentation).
- der Gewichtsausgleich nur in einwandfreiem Zustand eingebaut und betrieben wird.
- sich während des Betriebs keine Personen im Abblasebereich des Speichersicherheitsventils aufhalten.
- der Gewichtsausgleich nur von qualifiziertem Fachpersonal eingebaut und gewartet wird, und diesem die erforderliche Schutzausrüstung zur Verfügung steht und diese benutzt.
- keine Sicherheits- und Warnhinweise auf dem Gewichtsausgleich entfernt werden.
- die techn. Dokumentation zu Gewichtsausgleich, Druckspeicher und Speichersicherheitsventil vollständig und leserlich zur Verfügung steht.

3.2 Umgang mit Hydrauliköl

- Die Sicherheitshinweise für den Umgang mit Hydrauliköl sind zu beachten. Siehe auch die techn. Dokumentation für Speichersicherheitsventil unter Punkt 3.
ACHTUNG ! Der Gewichtsausgleich steht unter hohem Innendruck. Es dürfen keine Bauteile gelöst werden, solange das System unter Druck steht.

3.3 Stickstoffbefüllung des Druckspeichers

- Zum Befüllen nur Stickstoff N₂ der Reinheit 99,8 % verwenden !
IN KEINEM FALLE SAUERSTOFF ODER LUFT VERWENDEN ! EXPLOSIONSGEFAHR !!
Sofern der Gasflaschendruck höher als der max. zul. Druck ist, muss ein Gasdruckbegrenzungsventil verwendet werden.
- Die Sicherheitshinweise der Betriebsvorschrift für Einbau und Wartung des Druckspeichers sind zu beachten !

3.4 Thermische Gefährdung

- Bei Arbeiten am Gewichtsausgleich besteht die Gefahr von Verbrennungen durch Kontakt mit heißem Hydrauliköl oder erwärmtem Gerät.

3.5 Veränderungen am Gewichtsausgleich

- Am Gewichtsausgleich dürfen keine eigenmächtigen Veränderungen durchgeführt werden. Alle geplanten Veränderungen müssen von der Fa. ÖLHYDRAULIK ALTENERDING schriftlich genehmigt werden.
Das alternativ zum Luftfilter eingebaute Rückschlagventil für die Kolben- bzw Stangenraumentlüftung darf nicht verschlossen werden !

4. Inbetriebnahme

- Die Inbetriebnahme darf nur von qualifiziertem Fachpersonal durchgeführt werden.
- Nach dem Einbau des Gewichtsausgleichs ist das Hubdistanzstück zwischen Führung und Stangenauge (unter dem Faltenbalg) zu entfernen !! **
GEFAHR der Beschädigung durch Kollision !
- ** Ausnahme bei Type GA 14 und GA14-FO
Bei diesen Typen ist anstelle des Hubdistanzstückes ein Montagebolzen am Zylinderboden zur Hubbegrenzung eingeschraubt. Nach dem Einbau des Gewichtsausgleichs ist der Montagebolzen herauszuschrauben und durch die mitgelieferte Verschlussschraube zu ersetzen.
GEFAHR der Beschädigung durch Kollision, wenn der Montagebolzen nicht entfernt wird !
- Kontrolle des Öldruckes am Manometer. Auf ungewöhnliche Druckschwankungen und abweichenden Einstelldruck achten. Siehe Beschreibung der Baugruppe Punkt 4.

5. Wartung und Instandhaltung

Bei allen Wartungs- und Reparaturarbeiten ist auf äußerste Sauberkeit zu achten !

5.1 Kontrolle des allgemeinen Zustandes

- Gewichtsausgleich wöchentlich optisch auf Beschädigung, Verschmutzung und Dichtheit kontrollieren.

5.2 Überprüfung und Korrektur des Öldruckes

- Überprüfung des Öldruckes erfolgt am Manometer bei mechanischer Nullstellung der Achse 2.
- Zur Druckerhöhung gefiltertes Hydrauliköl vom Typ ARAL Vitam GF 46 verwenden.
- Folgende Anforderungen an das HLP Öl sind einzuhalten
kinematische Ölviskosität 40°C 46 cSt
Ölreinheit nach ISO DIS 4406 18/1571
bzw. NAS Klasse 7
Die Ölbefüllung erfolgt über das Rückschlagventil am Ölbefüllanschluss A. *
- Hierzu ist ein Hydraulikschlauch mit Verschraubung 8 S (Überwurfmutter M 16x1,5) sowie ein Pumpenaggregat mit Druckfilter erforderlich. Gleichzeitig ist über den Minimeßanschluss M16x2 am Entlüftungsanschluss E zu entlüften.
- Zur Druckreduzierung Öldruck über den Minimeßanschluss M16x2 ablassen.
- * Ausnahme bei Type GA 1 und GA 1 - A :
Die Ölbefüllung erfolgt über den Anschluss A. Hierzu ist die Verschlusschraube VSTI-R1/4" zu lösen und langsam herauszuschrauben !
ACHTUNG ! Gefahr durch herausspritzendes Öl bei Leckage des Absperrhahnes !
Anschließen des Befüllschlauches durch Einschrauben einer Hydraulikverschraubung GE 8 PSR (PB 630 bar). Den gewünschten Einstelldruck am Pumpenaggregat einstellen und über einen Druckfilter Öldruck auf den Anschluss A geben.
Jetzt die Flachkopfschraube am Absperrhahn entfernen und den Absperrhahn langsam herauszuschrauben und den Druck am Manometer des Gewichtsausgleichs kontrollieren.
Gleichzeitig an dem obenliegenden Minimeßanschluss M16x2 entlüften.
- Anschließend Absperrhahn wieder hineinschrauben und anziehen. Verschraubung GE 8 PSR entfernen und VSTI Verschlusschraube G1/4" wieder einschrauben und mit Anzugsmoment 30 Nm anziehen.
- Zur Druckreduzierung Öldruck über den Minimeßanschluss M16x2 ablassen.

5.3 Überprüfung und Korrektur des Gasdruckes

ACHTUNG !

**Druckspeicher steht unter Gasvorspannung !!
Sicherheitshinweise Punkt 3 beachten !**

- Überprüfung des Gasfülldruckes gemäß Betriebsvorschrift für Einbau und Wartung von Hydrospeichern durchführen.

5.4 Demontage und Wiedermontage

- Die Demontage und Wiedermontage des Gewichtsausgleichs darf ausschließlich von autorisierten Fachbetrieben mit entsprechenden Montage- und Demontageanweisungen durchgeführt werden.
- Bei unzulässigem Eingriff in den Gewichtsausgleich erlischt die Gewährleistung !

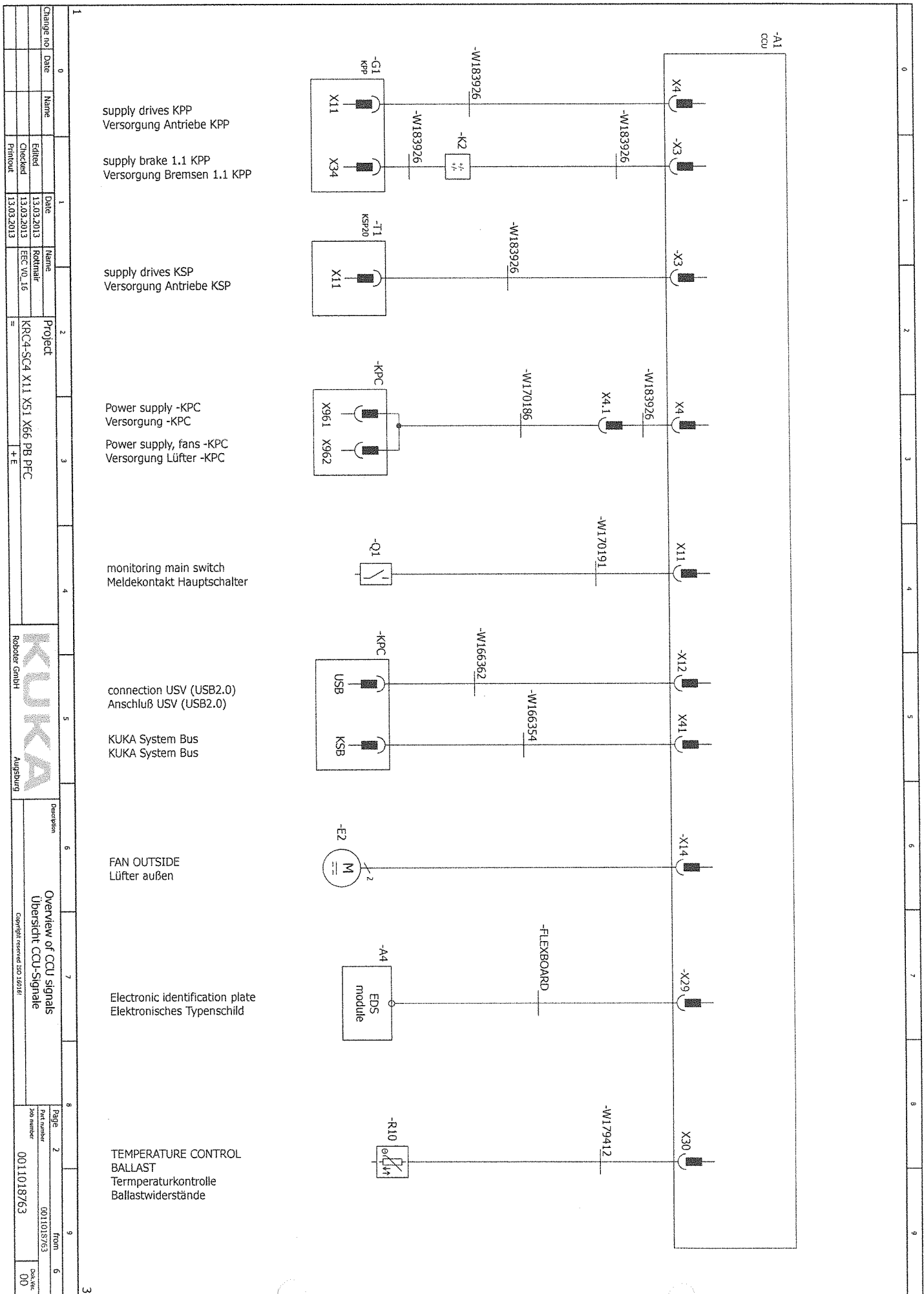
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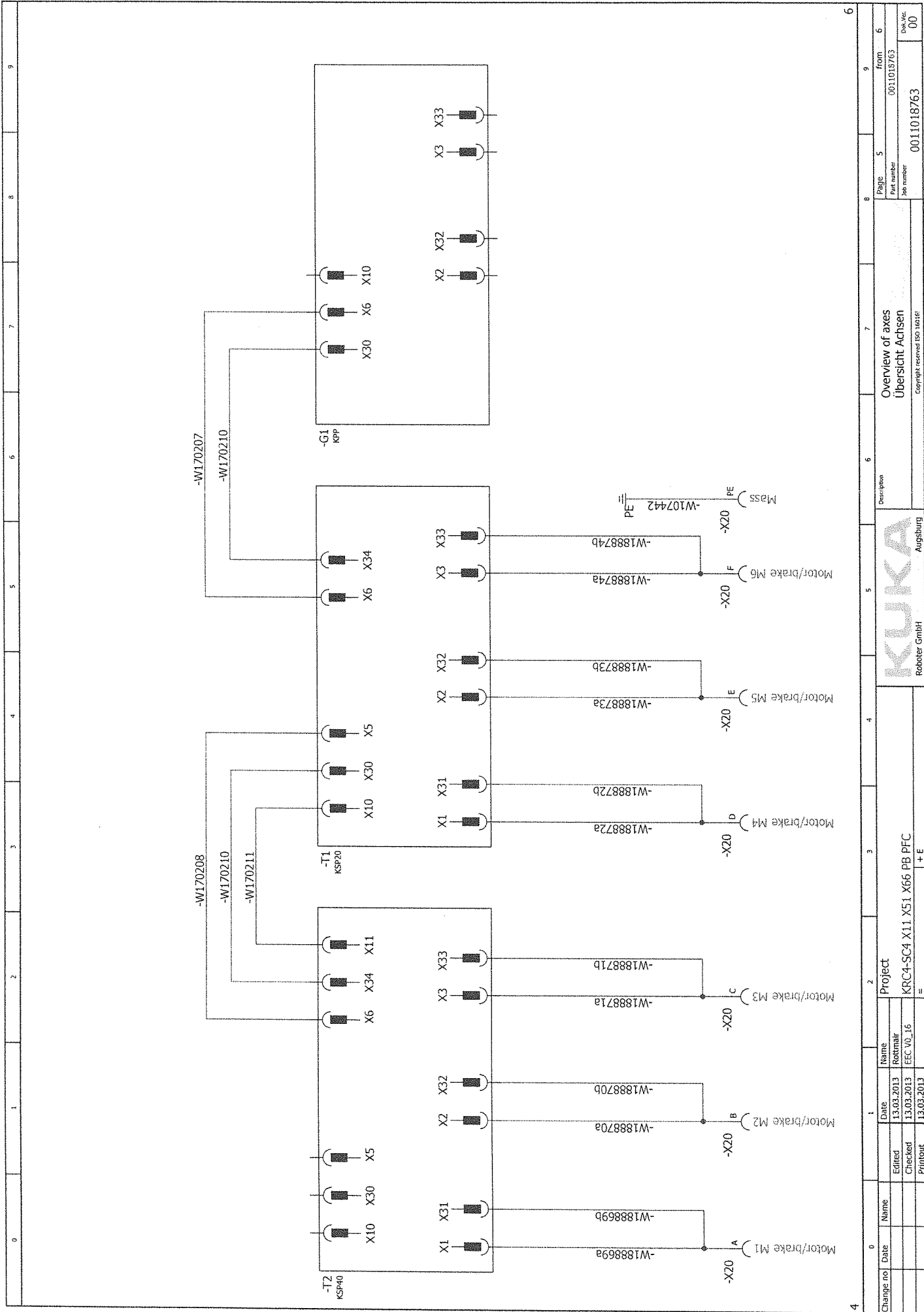
Higher-level function	Page	Description	Date	creator
+G		Circuit diagram Stromlaufplan		
	10	CCU connections Anschlüsse CCU	13.03.2013	Rottmair
	11	CCU connections Anschlüsse CCU	13.03.2013	Rottmair
	12	CCU connections Anschlüsse CCU	13.03.2013	Rottmair
	13	CCU connections Anschlüsse CCU	13.03.2013	Rottmair
	14	KCB bus connection KCB-BUS Verbindung	13.03.2013	Rottmair
	15	Interface -X11 Standard SIB Schnittstelle -X11 SIB Standard	13.03.2013	Rottmair
	16	Beckhoff module connections Anschlüsse Beckhoff Module	13.03.2013	Rottmair
	17	KPC signals KPC Signale	13.03.2013	Rottmair
	18	KPC signals KPC Signale	13.03.2013	Rottmair
+B		Layout Aufbau		
	1	MidSize housing front Gehaeuse MidSize vorn	13.03.2013	Rottmair
	2	MidSize housing rear Gehaeuse MidSize hinten	13.03.2013	Rottmair
	3	Housing top view / floor Gehaeuse Draufsicht / Boden	13.03.2013	Rottmair
	4	Connector panel Steckerfeld	13.03.2013	Rottmair
	5	right connector panel Steckerfeldblech rechts	13.03.2013	Rottmair
	6	-KPC slot assignment Steckplatzzuordnung -KPC	13.03.2013	Rottmair
	7	Beckhoff modules Beckhoff Module	13.03.2013	Rottmair
	8	Connector arrangement -A1 (CCU) Steckeranordnung -A1 (CCU)	13.03.2013	Rottmair
	9	Overview of SIB STD Übersicht SIB STD	13.03.2013	Rottmair
+KLM		Terminals Klemmen		
	1	Steckerplan =+G-X1 Steckerplan =+G-X1	13.03.2013	Rottmair

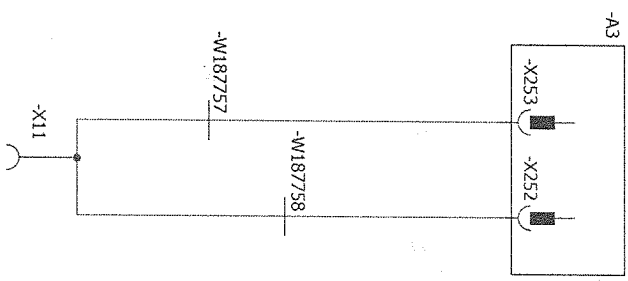
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Higher-level function	Page	Description	Date	Creator
Terminals Klemmen				
+KIM	2	Steckerplan =+G-X11	13.03.2013	Rottmair
	2	Steckerplan =+G-X11	13.03.2013	Rottmair
	2.a	Steckerplan =+G-X11	13.03.2013	Rottmair
	3	Steckerplan =+G-X19	13.03.2013	Rottmair
	4	Steckerplan =+G-X20	13.03.2013	Rottmair
	5	Steckerplan =+G-X21	13.03.2013	Rottmair
	6	Steckerplan =+G-X66	13.03.2013	Rottmair

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	13.03.2013	Rottmair	13.03.2013	Rottmair	KRC4-SC4 X11 X51 X66 PB PFC	KUKA	Inhaltsverzeichnis	21b	0011018763
	13.03.2013	Rottmair	13.03.2013	Rottmair	KRC4-SC4 X11 X51 X66 PB PFC	KUKA	Inhaltsverzeichnis	21b	0011018763
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Interface -X11
Schnittstelle -X11

5

Change no

Date

Name

Edited

13.03.2013

Rottnair

Checked

13.03.2013

FEC VO_16

Printout

13.03.2013

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Project

KRC4-SC4 X11 X51 X66 PB PFC

+ E

Robot

KUKA

GmbH

Augsburg

Description

Overview of interface

Übersicht Schnittstelle

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Page

6

Part number

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From

6

Dist. No.

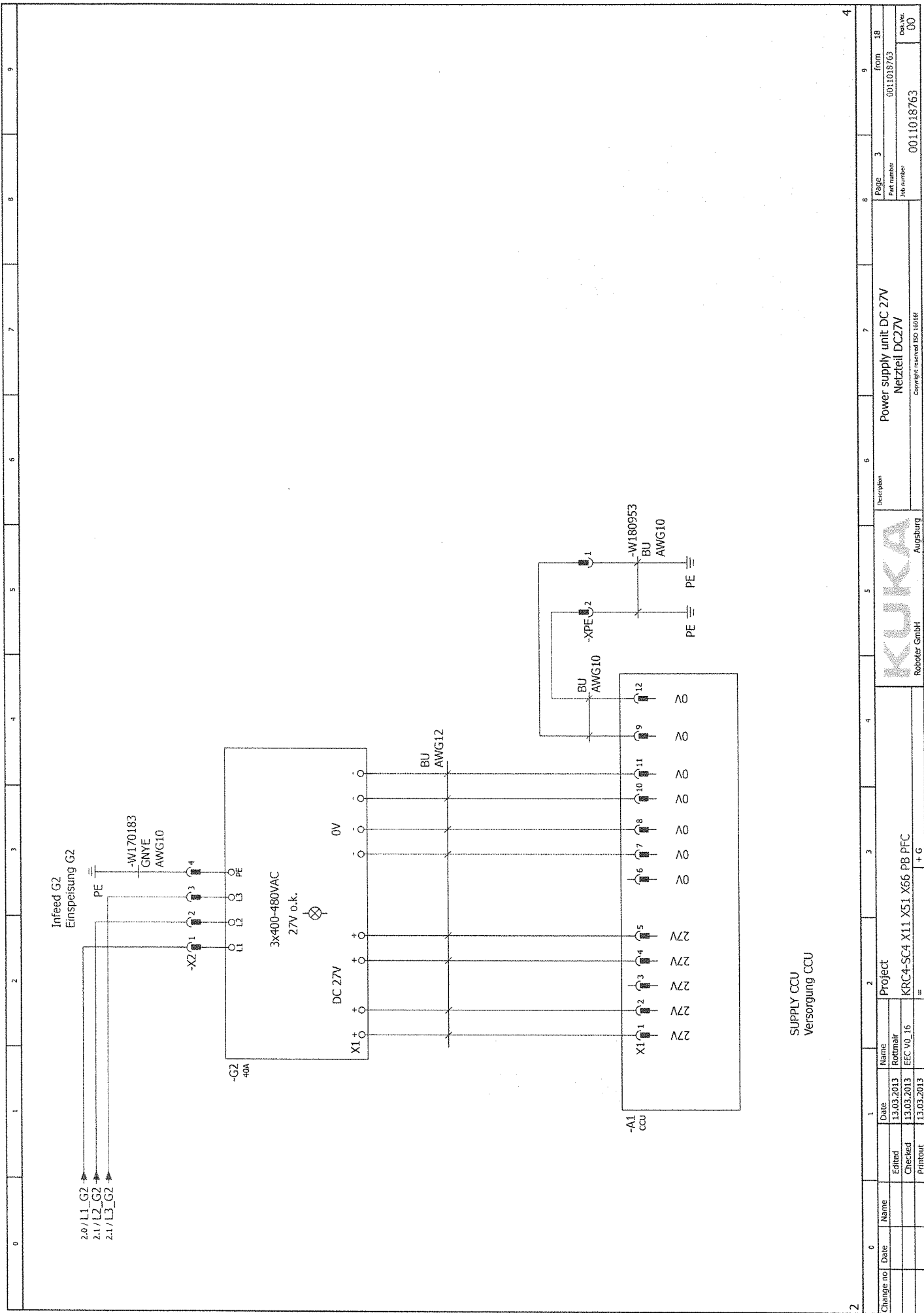
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+G/1

Distribution AC 400V
Verteilung AC 400V



SUPPLY CCU
Versorgung CCU

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	13.03.2013	Radtmaier	13.03.2013	EEC V0_16	KRC4-SC4 X11 X51 X66 PB PFC	3	0011018763	
	13.03.2013	Printout	13.03.2013			Part number	Job number	00
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KUKA
Roboter GmbH

Description
Power supply unit DC 27V
Netzteil DC27V

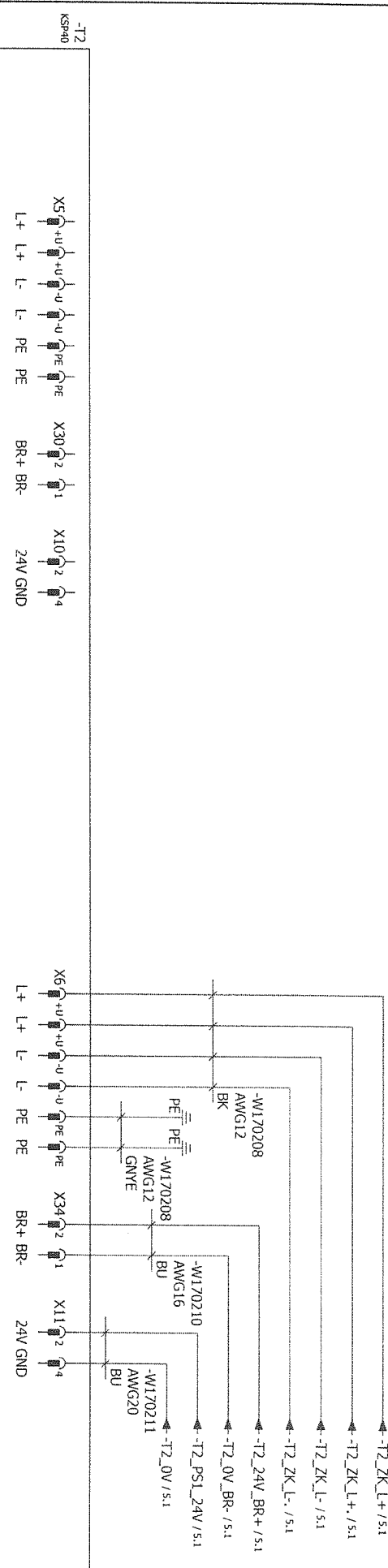
Page 3
Part number 0011018763
Job number 0011018763

5

6

6

TWIST ALL INTERMEDIATE CIRCUIT CABLE!
Alle ZK Leitungen verdrillen!



Motor M1 U1
Motor M1 V1
Motor M1 W1

Brake
of axis M1

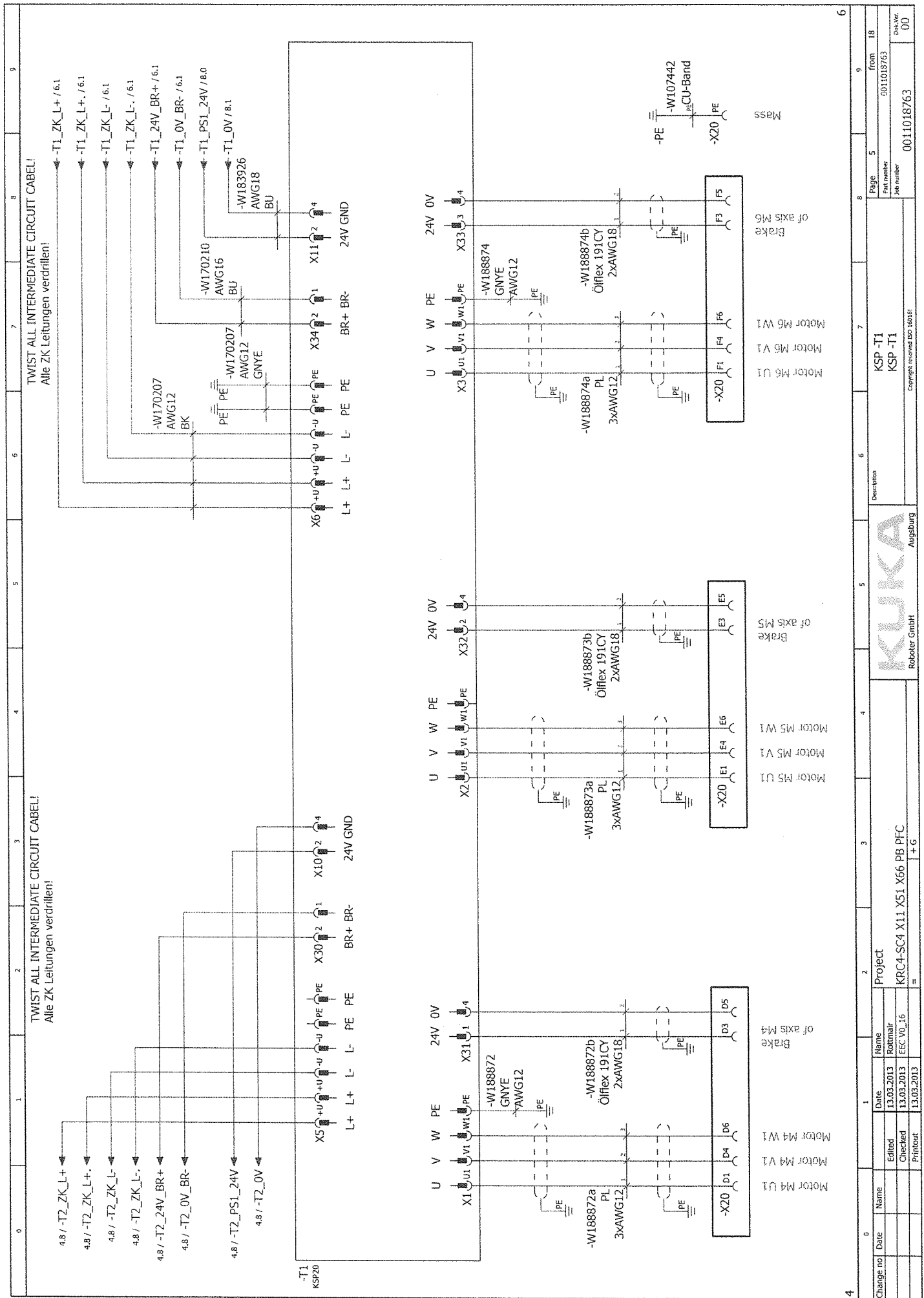
Motor M2 U1
Motor M2 V1
Motor M2 W1

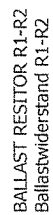
Brake
of axis M2

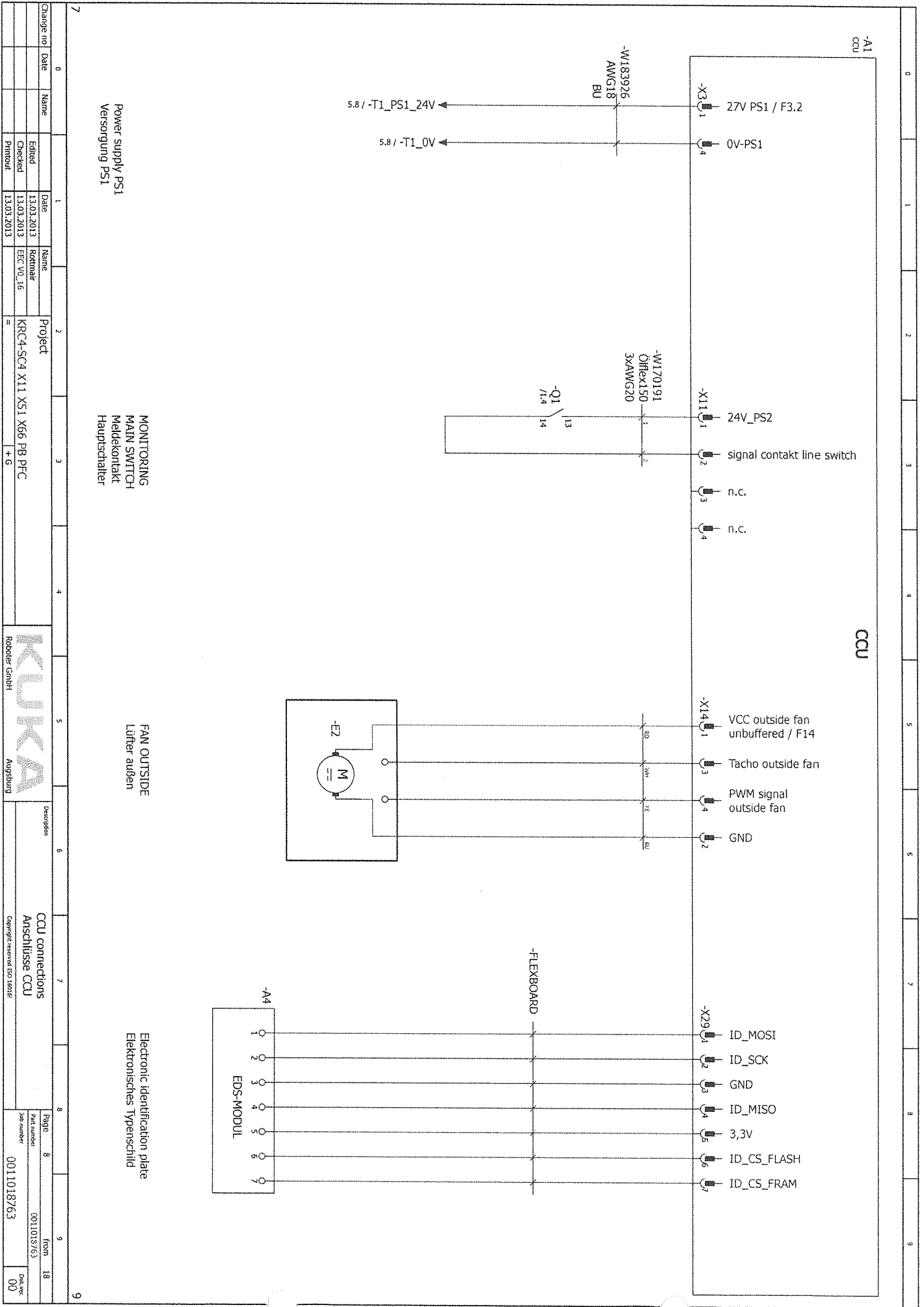
Motor M3 U1
Motor M3 V1
Motor M3 W1

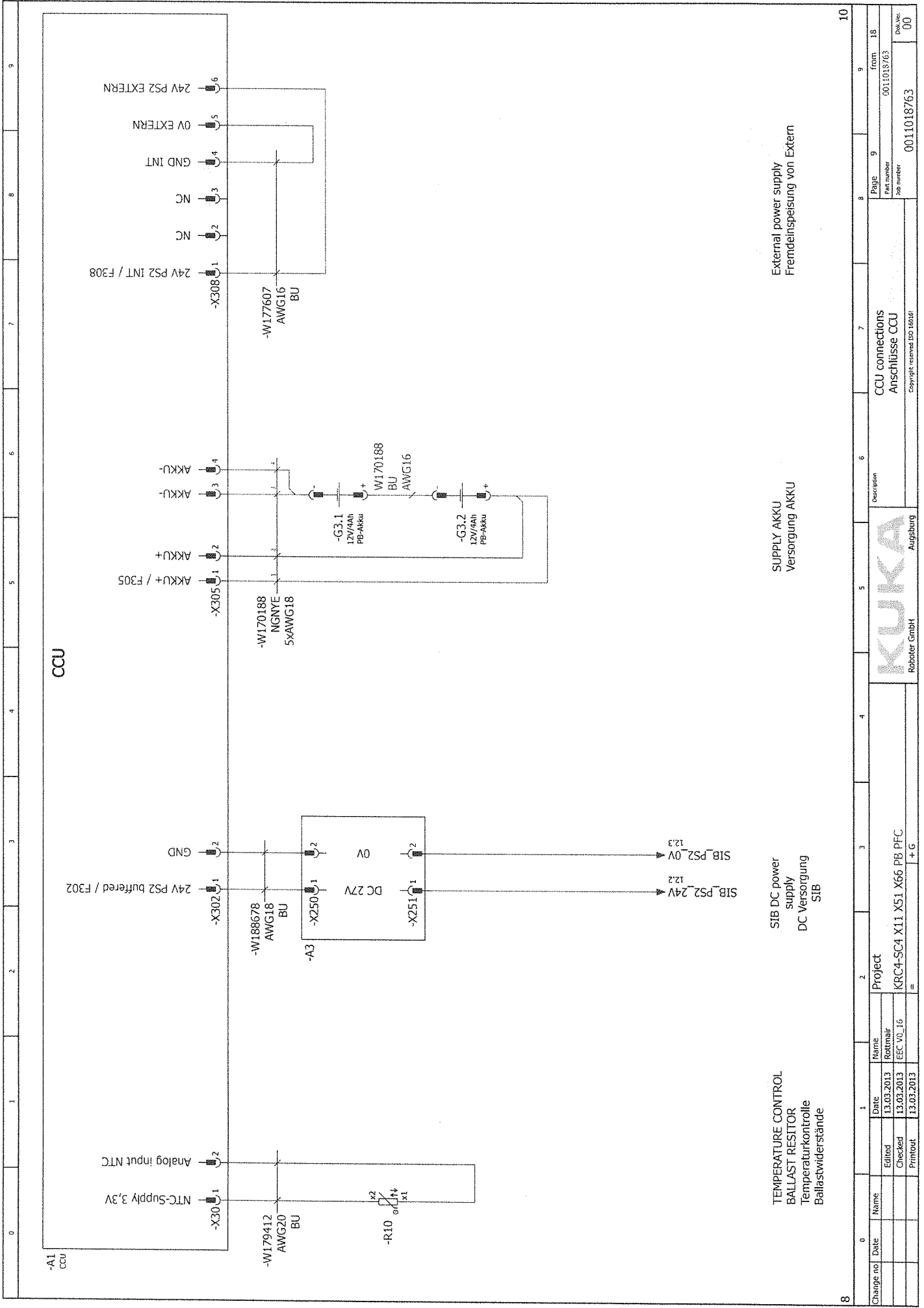
Brake
of axis M3

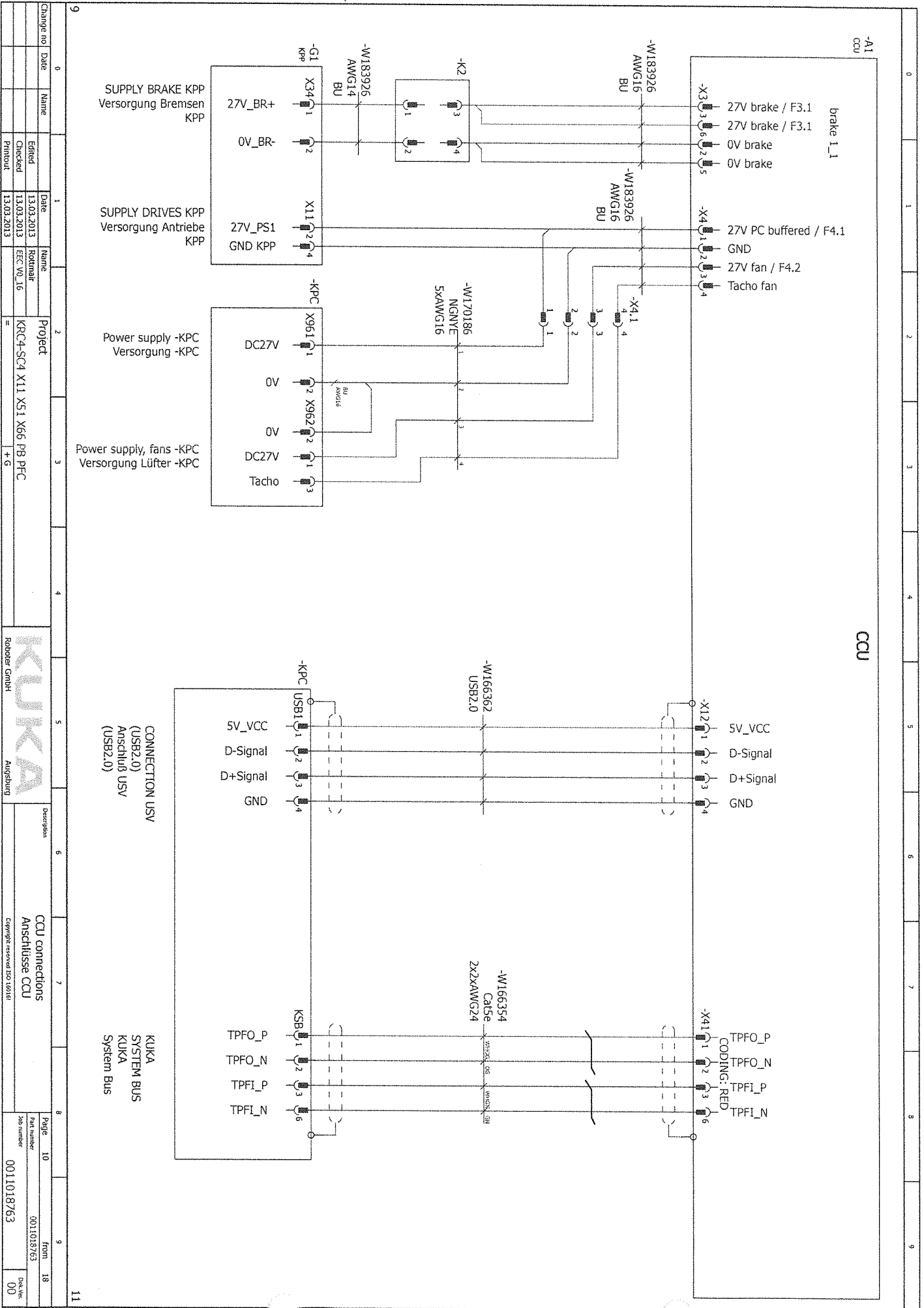
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										KUKA GmbH Augsburg									
										Copyright reserved ISO 10016									

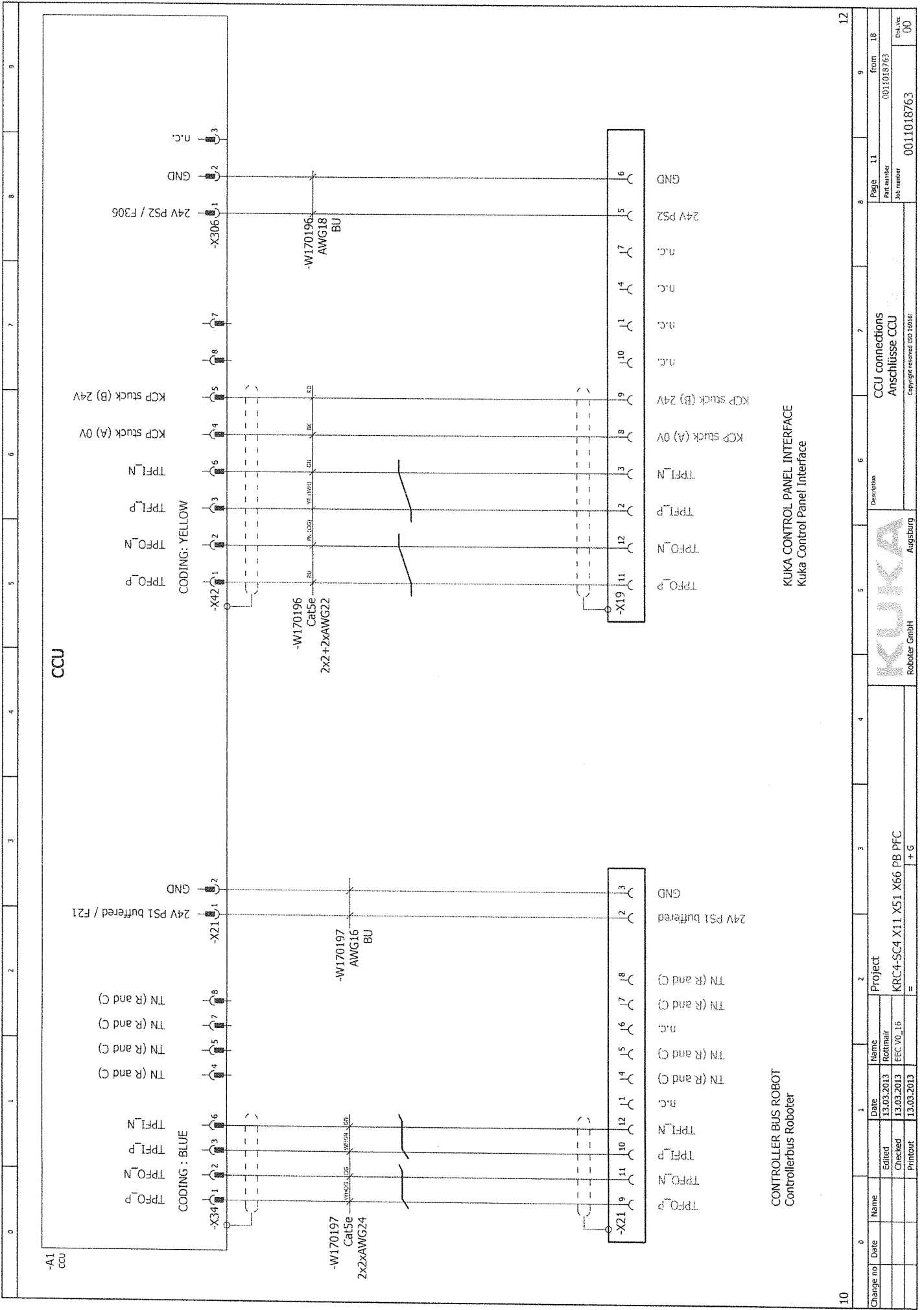


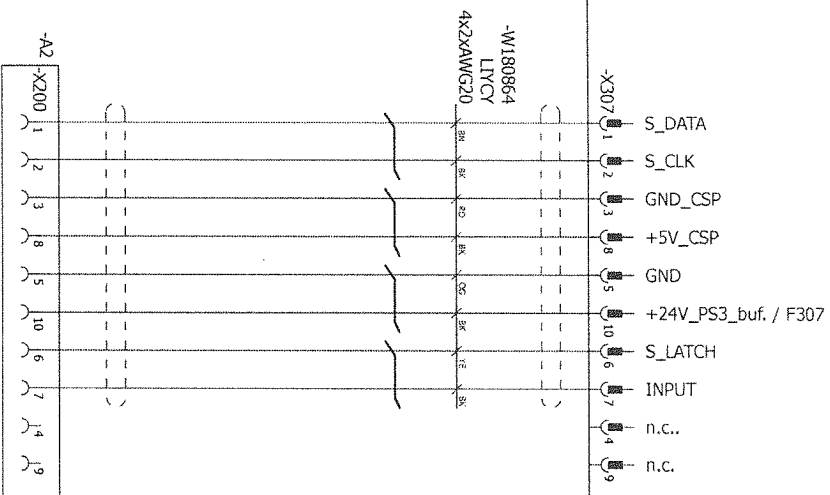






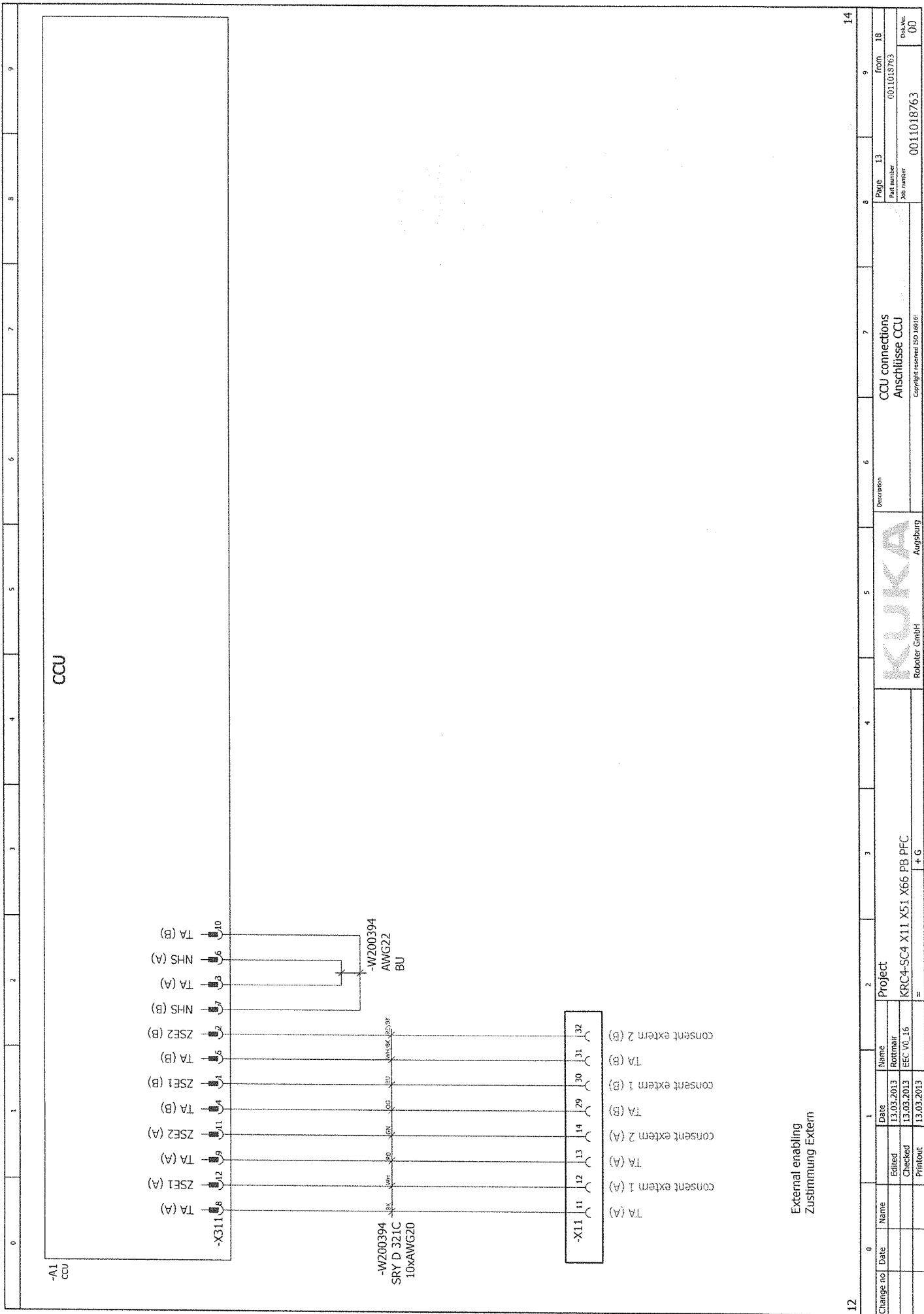






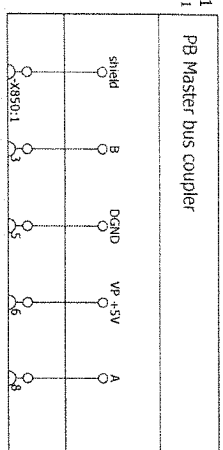
CSP CSP

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Part number	0011018763		
Job number	0011018763	Dok. Ver.	00

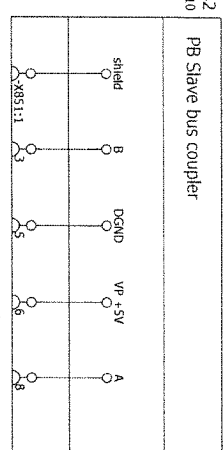


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-A31
EL6731
PB Master bus coupler

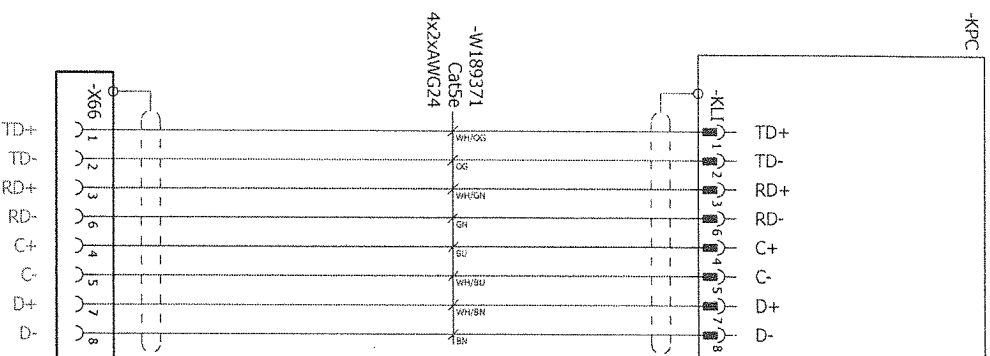


-A32
EL6731-0010
PB Slave bus coupler



Change no		Date		Name		Date		Name		Project		Description		Page		Part number		from		to		Del. Vt.	
										KRCA-SC4 X11 X51 X66 PB PFC		Beckhoff module connections Anschlüsse Beckhoff Module		16		0011018763		18					
		13.03.2013		Rothmair		13.03.2013		EEC VO_16		=		+ G											
		13.03.2013										KUKA Augsburg											

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Ethernet KLI -X66
Ethernet KLI -X66

17										+B/L											
0		1		2		3		4		5		6		7		8		9			
Change no	Name	Date	Name	Project								Description				Page 18		from 18			
	Edited	13.03.2013	Reinhardt	KRCA-SC4 X11 X51 X66 PB PFC								KPC signals				Part number		0011018763			
	Checked	13.03.2013	ECC VO_16									KPC Signale				Jag number		0011018763			
	Printout	13.03.2013	=	+G								Copyright reserved ISO 154181									
										KUKA				Rohrder GmbH				Augsburg			

Technical drawing of a KUKA MidSize housing front, showing two views: a front view and a side view.

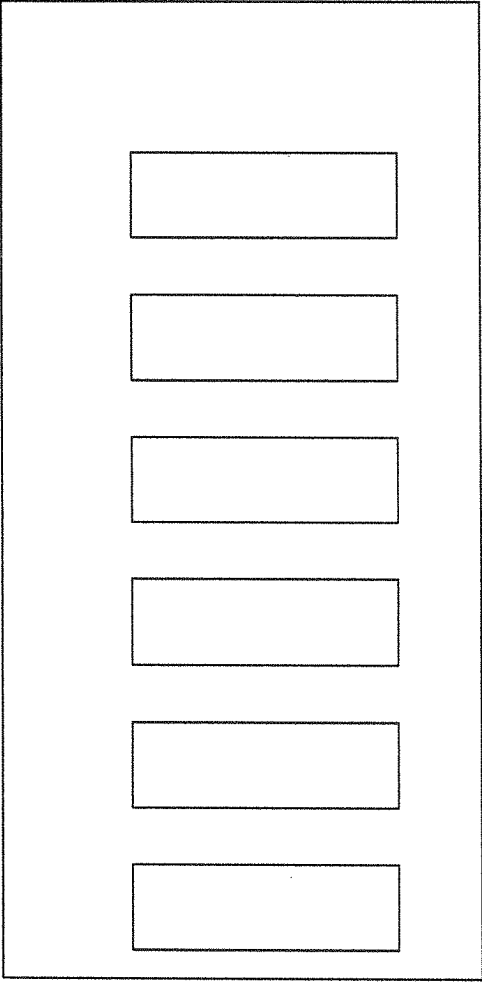
Front View: Shows the control panel with a 'CUSTOMER INTERFACE' section, a 'KUKA' logo, and a 'KPC' section. The panel is labeled 'KRC4-SC4 X11 X51 X66 PB PFC'.

Side View: Shows the internal components, including a 'KPC' section and a 'KUKA' logo. The panel is labeled 'KRC4-SC4 X11 X51 X66 PB PFC'.

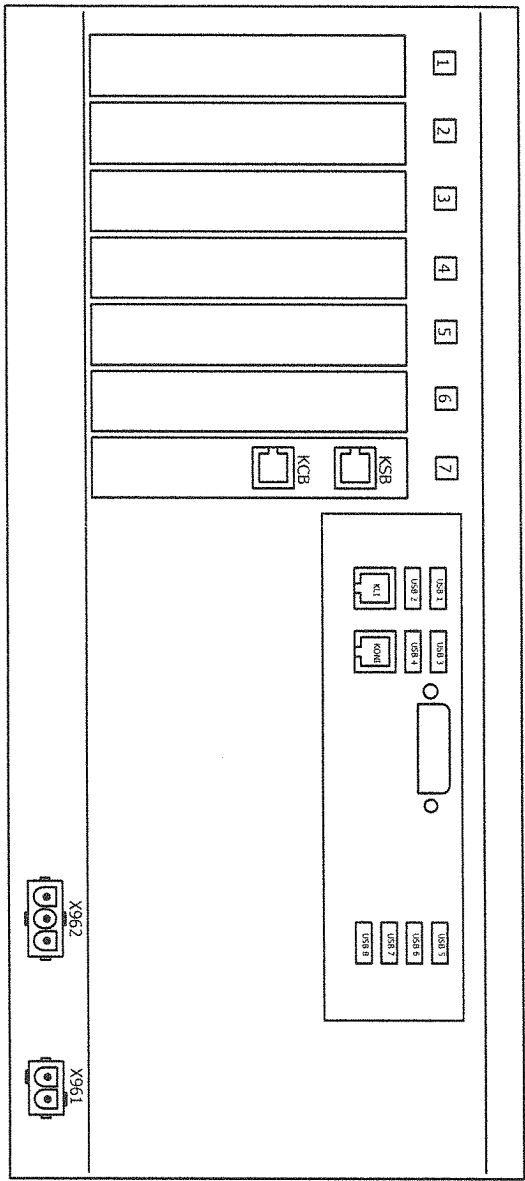
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1	13.03.2013	Redtmair	KRCA-SC4 X11 X51 X66 PB PFC		MidSize housing rear		0011018763		
2	13.03.2013	EEC VO_16			Gehäuse MidSize hinten		0011018763		
3	13.03.2013		+ B		Aufhebung		00		
Front view of the housing. Rear view of the housing.									
KUKA Reinhold GmbH Copyright reserved 200 10010									

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VIEW OUTSIDE Ansicht von Aussen									
									
4	1		2		3		4		6
Change no	Date	Name	Date		Name		Description		Page
			13.03.2013		Rottmair		right connector panel		5
			13.03.2013		EEC V0_16		Steckerfeldblech rechts		from 9
			13.03.2013		Printout		0011018763		0011018763
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Part number Job number									
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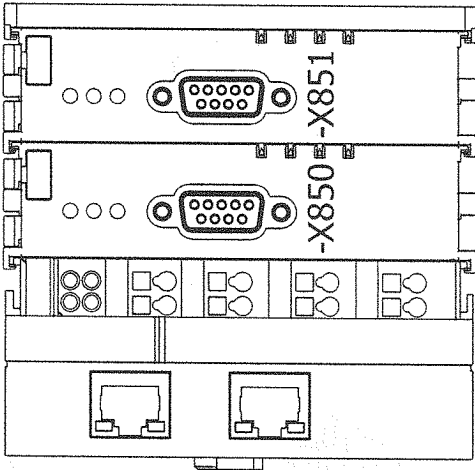
DUAL ETHERNETCARD



PC-COMPONENTS	
PC-Komponenten	
Motherboard	
Mainboard	
Main memory 2 GB	
Arbeitsspeicher 2 GB	
HDD	
HDD	
without	
ohne	
without	
ohne	
without	
ohne	
without	
ohne	
Dual Ethernet D2735	
Dual_Ethernet_D2735	



0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---



-A30 -A31 -A32

Buskoppler EtherCat
EK1100

Buskoppler PB Master
EL6731

Buskoppler PB Slave
EL6731-0010

EL9011

Change no	Date	Name	Date	Name	1	2	3	4	5	6	7	8	9
			13.03.2013	Rotmair									
			13.03.2013	EEC VO_16									
			13.03.2013										

Project				Beckhoff_modules		Page 7		from 9	
KRC4-SC4 X11 X51 X66 PB PFC				Beckhoff _Module		Part number 0011018763		Job number 0011018763	
= + B						Part number		Job number	
						00		00	



KUKA

Roboter GmbH Augsburg

Copyright reserved ISO 16066

 ∞

7. 函数 $f(x)$ 在 $[a, b]$ 上连续，在 (a, b) 内可导，且 $f(a) = f(b)$ ，则在 (a, b) 内至少存在一点 ξ ，使得 $f'(\xi) = 0$ 。

2

plug diagram

Strip designation
=+G-X11

function box	Target designation	Connection point	Plug designation	Jumper	device connection point	Target designation	Connection point	Cable type	Strip designation	Page / column
reserve output (A), O		44			-A3-X252	13	BK/RO	SRV D 321C		/15,6
local E-stop (B), J		55			-A3-X252	6	WH/BK			/15,6
local E-stop (B), O		56			-A3-X252	8	RO/BK			/15,7
quit operator safety (B), J		57			-A3-X252	7	GN/BK			/15,7
quit operator safety (B), O		58			-A3-X252	9	OG/BK			/15,7
Peri enabled (B), J		59			-A3-X252	15	BU/BK			/15,7
Peri enabled (B), O		60			-A3-X252	17	BK/WH			/15,7
reserve output (B), J		61			-A3-X252	16	RD/WH			/15,8
reserve output (B), O		62			-A3-X252	18	GN/WH			/15,8

Change no.	Date	Name	Date	Name	Project	3	4	5	6	7	8	9
	13.03.2013		13.03.2013	Rothmair	KPC4-SC4 X11 X51 X66 PB PFC							
	13.03.2013		13.03.2013	ECC VO_16	=							
	13.03.2013		13.03.2013		+ KLM							



Rotolder GmbH Augsburg

Steckerplan =+G-X11

Steckerplan =+G-X11

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Page 2.4

Part number 0011018763

Job number 0011018763

Drawn 00

Plug diagram

Strip designation
=+G-X21

function text	Target designation	Connection point	Plug designation	jumper	device connection point	Target designation	Connection point	cable type	Cable name	-W170197
n.c.		1				-A1-X21	1			
24V PS1 buffered		2				-A1-X21	2			
GND		3				-A1-X21				
TN (R and C)		4								
TN (R and C)		5								
n.c.		6								
TN (R and C)		7								
TN (R and C)		8				-A1-X34	1			
TPFL_P		9				-A1-X34	3			
TPFL_P		10				-A1-X34	2			
TPFL_N		11				-A1-X34	6			
TPFL_N		12				-A1-X34				

Page / Columns

/11.1

/11.2

/11.3

/11.1

/11.1

/11.2

/11.2

/11.2

/11.0

/11.1

/11.0

/11.1

Strip segregation
= +G-X66[illegible]



Industrie Service

ZERTIFIKAT

(Konformitätsbescheinigung)

Certificate of conformity

Prüfung des Produktes (Modul F) nach Richtlinie 97/23/EG

Product Verification (Module F) according to Directive 97/23/EC

Zertifikat-Nr.: Z-IS-ATA6-11-11-284661-364

Certificate No.:

Name und Anschrift
des Herstellers:
Name and postal address of manufacturer:

Herion Systemtechnik GmbH
Untere Talstr. 65
71263 Weil der Stadt

Hiermit wird bescheinigt, dass die Ergebnisse der an dem unten genannten Druckgerät vorgenommenen Prüfungen die Anforderungen der Richtlinie 97/23/EG erfüllen. Das Druckgerät entspricht der EG-Baumusterprüfung und ist mit unserer Kennnummer gemäß dem abgebildeten CE-Kennzeichen gekennzeichnet:

We herewith certify that the results of the examinations of the pressure equipment meet the requirements of the directive 97/23/EC. The pressure equipment complies with the EC type examination and carries our identification number to the CE-mark as illustrated:

CE 0036

Prüfbericht Nr.:
Test report No.:

P-IS-ATA6-11-11-284661-364

Geltungsbereich:
Scope of examination:

TÜV.SV.00-527.6.F.70.330
Fabrikations-Nr. 1146311 - 1146360
DBC6HKE990171F0

Fertigungsstätte:
Manufacturing plant:

Herion Systemtechnik GmbH
Untere Talstr. 65
71263 Weil der Stadt

TÜV SÜD Industrie Service GmbH
Zertifizierungsstelle
für Druckgeräte



Filderstadt, 22. November 2011
(Ort, Datum)
(Place, date)

TÜV SÜD Industrie Service GmbH
Bereich Anlagentechnik
Abteilung Verschleiß- und Schweißtechnik
Gottlieb-Daimler-Straße 7
70794 Filderstadt

Benannte Stelle
Notified Body

Benannte Stelle, Kennnummer 0036
Notified Body, No. 0036



600 117 253_Zertifikat.doc

DGR Zertifikat Modul F.doc

600 117 253_Zertifikat.doc

DGR Zertifikat Modul F.doc

Seite 2 zum Zertifikat Nr. (Page 2 of certificate no.)
Z-IS-ATA6-11-11-284661-364
Richtlinie (Directive) 97/23/EG (EC) - Modul (e) F
Hersteller (Manufacturer)
Herion Systemtechnik GmbH
Untere Talstr. 65
71263 Weil der Stadt



Industrie Service

Notes on the TÜV Certificate

The right to use the symbol depicted in the certificate only applies to the product named in the certificate.

All necessary operating or mounting instructions have to be supplied with each product. For transportation purposes, the certification body may allow the holder of the TÜV Certificate to disassemble the products fitted out with the symbol in such a way as is usual for product assembly in an installation.

The holder of the TÜV Certificate is obliged to monitor the fabrication of the products fitted out with the symbol in order to ensure that production is carried out in accordance with the examination specifications. The holder of the certificate is particularly obliged to carry out the monitoring examinations which are laid down in the examination specifications or required by the certification body.

If this certificate expires or is declared invalid it has to be returned to the Certification Body immediately.

A TÜV Certificate can be declared invalid or terminated by the certification body, if

- any flaws appear after the examination which were not detectable or not found during the examination.
- the symbol is used for the purpose of misleading or in any other way illicit advertising.
- due to facts which were not clearly detectable at the time of certification, further use of the symbol is not justifiable.

The holder of the TÜV Certificate is obliged to report any damage to or incurred by certified products to the certification body.

The holder of the TÜV Certificate is only allowed to pass on examination reports and certificates by using the full text and by stating the date of issue. Publication of excerpts or duplication of the documents requires prior consent by the certification body.

With the certificate holder's consent, the certification body reserves the right to publish a list of certified products for the purpose of consumer information.

Hinweise zum TÜV-Zertifikat

Das Recht zum Benutzen des im Zertifikat abgebildeten Zeichens erstreckt sich nur auf das angegebene Produkt.

Notwendige Bedienungs- und Montageanweisungen müssen jedem Produkt beigelegt werden. Die Zertifizierungsstelle kann dem Inhaber des TÜV-Zertifikates erlauben, die mit dem Zeichen versehenen Produkte für den Versand soweit zu zerlegen, wie es zum Einbau des Produktes in eine Anlage normalerweise geschieht.

Der Inhaber des TÜV-Zertifikates ist verpflichtet, die Fertigung der mit dem Zeichen versehenen Produkte laufend auf Übereinstimmung mit den Prüfbesimmungen zu überwachen und insbesondere die in den Prüfbesimmungen festgelegten oder von der Zertifizierungsstelle geforderten Kontrollprüfungen ordnungsgemäß durchzuführen.

Falls dieses TÜV-Zertifikat ungültig wird oder für ungültig erklärt wird, muss es unverzüglich der Zertifizierungsstelle zurückgegeben werden.

Ein TÜV-Zertifikat kann von der Zertifizierungsstelle für ungültig erklärt oder gekündigt werden, wenn

- sich nachträglich an den Produkten bei der Prüfung nicht erkennbare oder nicht festgestellte Mängel herausstellen,
- mit dem Zeichen irreführende oder anderweitig unzulässige Werbung betrieben wird.
- aufgrund nicht einwandfrei zu erkennen waren, die Prüfung Verwendung des Zeichens im Hinblick auf seine Aussagekraft am Markt nicht vertretbar ist.

Der Inhaber des TÜV-Zertifikates ist verpflichtet, Schäden den mit geprüften Produkten der Zertifizierungsstelle mitzuteilen.

Der Inhaber des TÜV-Zertifikates darf Prüfberichte und Zertifikate nur im vollen Wortlaut unter Angabe des Ausstellungsdatums weitergeben. Eine auszugsweise Veröffentlichung oder eine Vervielfältigung bedarf der vorherigen Genehmigung der Zertifizierungsstelle.

Die Zertifizierungsstelle behält sich mit Zustimmung des Zertifikatsinhabers die Veröffentlichung einer Liste der zertifizierten Produkte zur Verbraucherinformation vor.

Liste der eingehaltenen grundlegenden Anforderungen nach Anhang I, RL 2006/42/EG

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668163
Steuerungstyp:	KRC4
Seriennummer Steuerung:	211005

Nicht relevant
Durch den Systemintegrator für die Gesamtmaschine zu leisten
Für den Umfang der unvollständigen Maschine erfüllt

Kapitel	Anforderungen			
1.	GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN			
1.1.	ALLGEMEINES			
1.1.1.	Begriffsbestimmungen			X
1.1.2.	Grundsätze für die Integration der Sicherheit	X	X	
1.1.3.	Materialien und Produkte	X	X	
1.1.4.	Beleuchtung		X	
1.1.5.	Konstruktion der Maschine im Hinblick auf die Handhabung	X	X	
1.1.6.	Ergonomie	X	X	
1.1.7.	Bedienungsplätze		X	
1.1.8.	Sitze			X
1.2.	STEUERUNGEN UND BEFEHLSEINRICHTUNGEN			
1.2.1.	Sicherheit und Zuverlässigkeit von Steuerungen	X	X	
1.2.2.	Stellteile	X	X	
1.2.3.	Ingangsetzen	X	X	
1.2.4.	Stillsetzen			
1.2.4.1.	Normales Stillsetzen	X	X	
1.2.4.2.	Betriebsbedingtes Stillsetzen	X	X	
1.2.4.3.	Stillsetzen im Notfall	X	X	
1.2.5.	Wahl der Steuerungs- oder Betriebsarten	X	X	
1.2.6.	Störung der Energieversorgung	X	X	
1.3.	SCHUTZMASSNAHMEN GEGEN MECHANISCHE GEFÄHRDUNGEN			
1.3.1.	Risiko des Verlusts der Standsicherheit	X		
1.3.2.	Bruchrisiko beim Betrieb	X		
1.3.3.	Risiken durch herabfallende oder herausgeschleuderte Gegenstände		X	
1.3.4.	Risiken durch Oberflächen, Kanten und Ecken	X		
1.3.5.	Risiken durch mehrfach kombinierte Maschinen	X	X	
1.3.6.	Risiken durch Änderung der Verwendungsbedingungen		X	
1.3.7.	Risiken durch bewegliche Teile	X	X	
1.3.8.	Wahl der Schutzeinrichtungen gegen Risiken durch bewegliche Teile		X	
1.3.8.1.	Bewegliche Teile der Kraftübertragung	X	X	
1.3.8.2.	Bewegliche Teile, die am Arbeitsprozess beteiligt sind		X	
1.3.9.	Risiko unkontrollierter Bewegungen	X	X	
1.4.	ANFORDERUNGEN AN SCHUTZEINRICHTUNGEN			
1.4.1.	Allgemeine Anforderungen		X	
1.4.2.	Besondere Anforderungen an trennende Schutzeinrichtungen		X	
1.4.2.1.	Feststehende trennende Schutzeinrichtungen		X	
1.4.2.2.	Bewegliche trennende Schutzeinrichtungen mit Verriegelung		X	

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	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

Kapitel	Anforderungen			
1.4.2.3.	Zugangsbeschränkende verstellbare Schutzeinrichtungen		X	
1.4.3.	Besondere Anforderungen an nichttrennende Schutzeinrichtungen		X	
1.5.	RISIKEN DURCH SONSTIGE GEFÄHRDUNGEN			
1.5.1.	Elektrische Energieversorgung	X	X	
1.5.2.	Statische Elektrizität	X	X	
1.5.3.	Nichtelektrische Energieversorgung		X	
1.5.4.	Montagefehler	X	X	
1.5.5.	Extreme Temperaturen	X	X	
1.5.6.	Brand	X	X	
1.5.7.	Explosion			X
1.5.8.	Lärm	X	X	
1.5.9.	Vibrationen			X
1.5.10.	Strahlung	X		
1.5.11.	Strahlung von außen	X		
1.5.12.	Laserstrahlung		X	
1.5.13.	Emission gefährlicher Werkstoffe und Substanzen	X	X	
1.5.14.	Risiko, in einer Maschine eingeschlossen zu werden		X	
1.5.15.	Ausrutsch-, Stolper- und Sturzrisiko		X	
1.5.16.	Blitzschlag	X	X	
1.6.	INSTANDHALTUNG			
1.6.1.	Wartung der Maschine	X	X	
1.6.2.	Zugang zu den Bedienungsständen und den Eingriffspunkten für die Instandhaltung		X	
1.6.3.	Trennung von den Energiequellen	X	X	
1.6.4.	Eingriffe des Bedienungspersonal		X	
1.6.5.	Reinigung innen liegender Maschinenteile		X	
1.7.	INFORMATIONEN			
1.7.1.	Informationen und Warnhinweise an der Maschine	X	X	
1.7.1.1.	Informationen und Informationseinrichtungen	X	X	
1.7.1.2.	Warneinrichtungen		X	
1.7.2.	Warnung vor Restrisiken		X	
1.7.3.	Kennzeichnung der Maschinen		X	
1.7.4.	Betriebsanleitung		X	
1.7.4.1.	Allgemeine Grundsätze für die Abfassung der Betriebsanleitung		X	
1.7.4.2.	Inhalt der Betriebsanleitung		X	
1.7.4.3.	Verkaufsprospekte	X	X	
2.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN BESTIMMTE MASCHINENGATTUNGEN			
2.1.	NAHRUNGSMITTELMASCHINEN UND MASCHINEN FÜR KOSMETISCHE ODER PHARMAZEUTISCHE ERZEUGNISSE			X
2.2.	HANDGEHALTENE UND/ODER HANDGEFÜHRTE TRAGBARE MASCHINEN			X
3.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN ZUR AUSSCHALTUNG DER GEFÄHRDUNGEN, DIE VON DER BEWEGLICHKEIT VON MASCHINEN AUSGEHEN			X
4.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN ZUR AUSSCHALTUNG DER DURCH HEBEVORGÄNGE BEDINGTEN GEFÄHRDUNGEN			X
5.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN MASCHINEN, DIE ZUM EINSATZ UNTER TAGE BESTIMMT SIND			X
6.	ZUSÄTZLICHE GRUNDLEGENDE SICHERHEITS- UND GESUNDHEITSSCHUTZANFORDERUNGEN AN MASCHINEN, VON DENEN DURCH DAS HEBEN VON PERSONEN BEDINGTE GEFÄHRDUNGEN AUSGEHEN			X

Hinweise zur Montageanleitung nach Anhang VI, RL 2006/42/EG

Produktbezeichnung:	Industrieroboter
Typ :	KR 150 R3300 K prime
Seriennummer :	668163
Steuerungstyp:	KRC4
Seriennummer Steuerung:	211005

Die Montageanleitung gibt dem, der oben genannte unvollständige Maschine in eine Maschine einbaut oder mit anderen Teilen zu einer vollständigen Maschine zusammenbaut, die notwendigen Informationen, insbesondere über die sicherheitsrelevanten Schnittstellen, für den ordnungsgemäßen Zusammenbau ohne Beeinträchtigung der Sicherheit und Gesundheit von Personen.

Zusätzlich zu dieser Montageanleitung sind die relevanten europäischen Richtlinien und nationalen Vorschriften zu beachten.

Zur Übereinstimmung mit den grundsätzlichen Anforderungen der EG-Maschinen-Richtlinie wird empfohlen, die beiden Normen für Industrieroboter-Sicherheitsanforderungen EN ISO 10218-1 und EN ISO 10218-2 anzuwenden.

Die Montageanleitung zusammen mit der Einbauerklärung und deren Anhängen, verbleibt bei der unvollständigen Maschine bis zu ihrem Einbau in die vollständige Maschine und ist danach den technischen Unterlagen der vollständigen Maschine beizufügen.

Die Montageanleitung selbst befindet sich in elektronischer Form auf einem beigefügten Datenträger. Zum Lesen wird ein PC mit einem entsprechenden Programm zum Darstellen von PDF-Dateien benötigt.

Die wichtigsten Inhalte der Montageanleitung sind im Anhang 3 Allgemeine Sicherheitshinweise zum Produkt zusammengefasst. Diese Inhalte befinden sich ebenfalls in der vollständigen Montageanleitung zur entsprechenden Komponente.

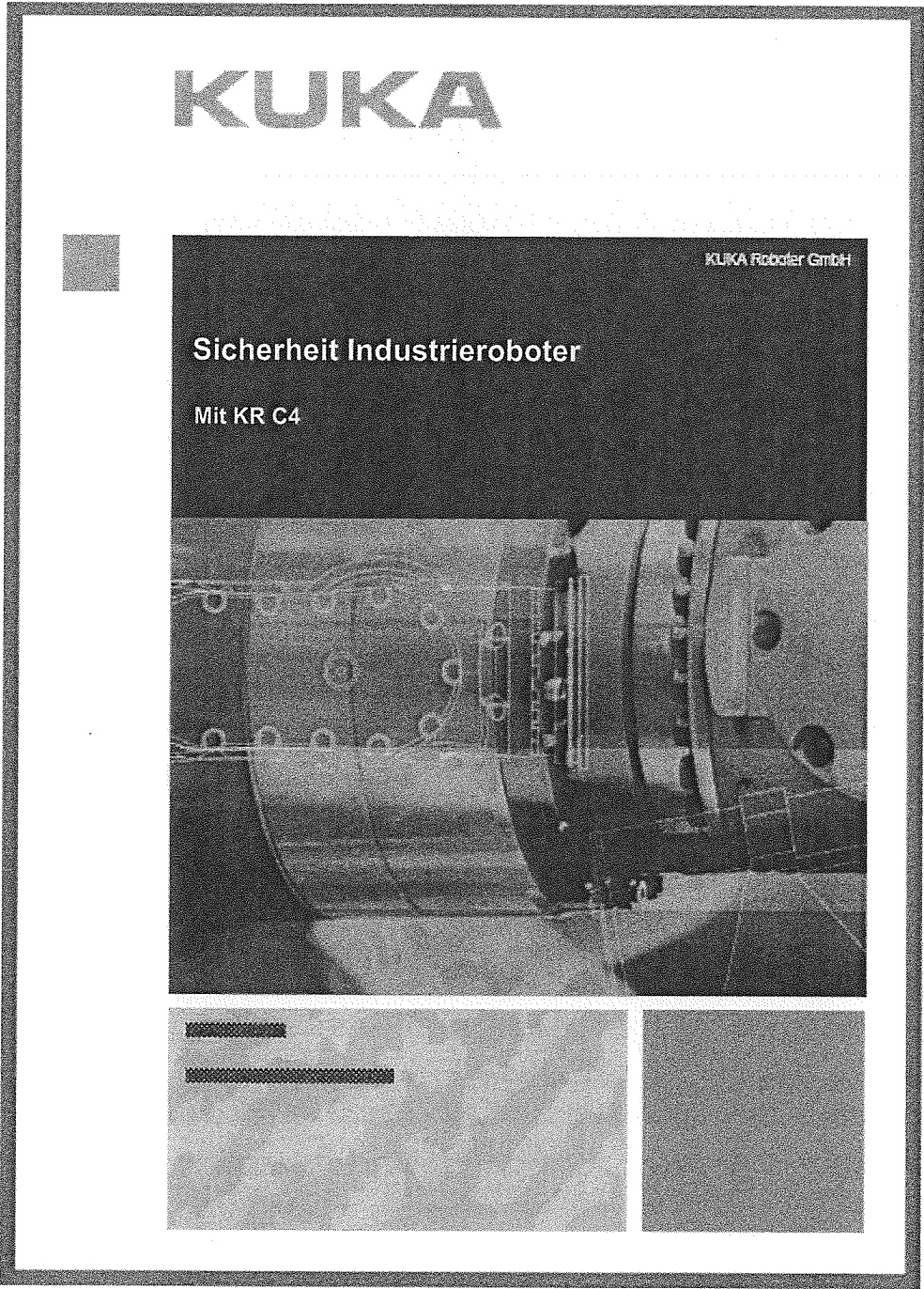
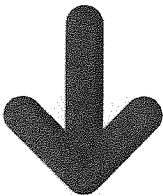
Zu jeder Komponente des Industrieroboters (Manipulator, Steuerung, Optionen) befindet sich eine eigenständige und vollständige Montageanleitung auf dem Datenträger, die über die Typenbezeichnung eindeutig zu identifizieren ist.

Sollte es nicht möglich sein den Datenträger zu lesen, kontaktieren Sie bitte unsere Hotline:

Tel.: +49 821 797 1926
Email: hotline@kuka-roboter.de

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	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

Allgemeine Sicherheitshinweise zum Produkt



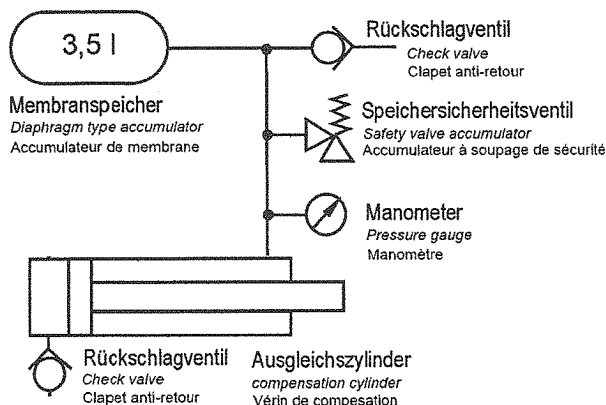
135-de	geändert / edited	sachlich geprüft / checked	Freigegeben / released	Version: V04
	S. Dreher	U. Kisch	U. Kisch	
	2011-02-21	2011-02-21	2011-02-21	

1. Gewichtsausgleich / Counterweight / Contrepoids

Type: GA14
 ÖA-Zg.-Nr. / ÖA-drawing-No. / ÖA-dessin n°: 1144.00.000
 KUKA-Zg.-Nr. / KUKA-drawing-No. / ÖA-dessin n°: 394.056-06.010.10
 KUKA-Sachnr. / KUKA-Item No. / KUKA-N° art.: 00-183-637

Seriennummer:
 Serial No.: **000153.02.1**
 Numéro de série

2. Anschlußschema / Connection diagram / Schéma de raccordement



3. Bestandteile der Baugruppe / Assembly components / Composantes de l'assemblée

Bezeichnung Designation Désignation	Hersteller Manufacturer Fabricant	Typ Type Type	Kategorie nach Art. 9 der DGRL Category according to the article 9 of the PED Catégorie selon l'article 9 de la DESP	Abnahme nach Modul Approval to module Réception selon le module
Membranspeicher Diaphragm type accumulator Accumulateur de membrane	HYDAC	SBO 330-3,5 ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530069 Seriennr. / Serial No. / Numéro de série: 0851880	III	B + D
Ausgleichszylinder mit Anschlußflansch Compensating cylinder with flange Vérin de compensation avec Brîde	ÖLHYDRAULIK	1144.01.000	Ausnahme nach Art. 1, 3.10 der DRGL Exception in accordance with article 1, 3.10 of the PED Exception dans l'article 1, 3.10 de la DESP	---
Rückschlagventil Check valve Clapet anti-retour	Parker Ermeto	ÖA-Artikelnr.: 530115/1 ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530017	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---
Speichersicherheitsventil Check valve Clapet anti-retour	Herion	TÜV.SV.00-527.6.F.70.330 ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 5 Seriennr. / Serial No. / Numéro de série: 1146317	IV	B + F
Manometer Pressure gauge Manomètre	WIKA	0 - 400 bar rote Markierung bei 330 bar ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 510114	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---
Rückschlagventil Check valve Clapet anti-retour	Parker Ermeto	RHV 10 LME OMD A3C ÖA-Artikel-Nr. / ÖA-Item No. / ÖA N°art.: 530079	gute Ingenieurpraxis Good engineering practice bonnes pratiques d'ingénierie	---

4. Durchgeführte Tests und Prüfungen / Performed tests and checks / Tests et contrôles effectués

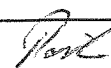
- Druckprüfung des Zylinders mit 330 bar (nur bei 10 %)
Pressure test of the cylinder at 330 bar (only 10 % is required)
Pression d'essai dans les vérins: 330 bar (seulement le 10 % est nécessaire) Ja / yes / oui
- Spülen des kompletten Gewichtsenausgleiches / Rinse the entire counterweight / Rincage complet du contrepoids Ja / yes / oui
- Befüllen und Entlüften / Filling and bleeding / Remplissage et purge Ja / yes / oui
- Druckeinstellung des Öldruckes auf / Pressure setting of the oil pressure on /
Réglage de la pression d'huile sur 185 bar

5. Bemerkungen / Comments / Commentaires

Der max. zulässige Druck [PS] für die Baugruppe beträgt 330 bar!

Datum / Date / Date: 12.07.12

Unterschrift des Prüfers
 Signature of Inspector / Signature du contrôleur:



ÖLHYDRAULIK ALTENERDING
Dechamps & Kretz GmbH & Co. KG
Albert-Einstein-Straße 10 - 12
D-85435 Erding

Formular-Nr.
MO-017

Der Hersteller der Baugruppe Gewichtsausgleich mit den nachstehenden Angaben:
The manufacturer of the assembly (Counterweight) with the following information:
Le fabricant de l'assemblage (contrepoids) ci-dessous:

Hersteller / Manufacturer / Fabricant:	ÖLHYDRAULIK ALTENERDING; Dechamps & Kretz GmbH & Co. KG		
Herstellerzeichen: Manufacturer's logo: Marque du fabricant:		Herstelljahr: Year of manufacture: Année de fabrication:	2012
Baugruppe Gewichtsausgleich: Assembly (counterweight): Assemblage (contrepoids):	Seriennr. / Serial number / N° de Serie:	000153.02.1	
	Type:	GA14	
Max. zulässiger Druck [PS] in bar Maximum allowable pressure [PS] in bar / Pression maximale admissible en bar:		330	
Inhalt in l / Capacity in l / Capacité en l:		3,5	
Zulässige max./min. Temperatur [TS] in °C Allowable max./min. temperature [TS] in °C / Température max./min. admissible en °C:		+ 55 / - 10	
Druckschwankungsbreite / Pressure fluctuation / Fluctuation de pression:		169 ... 312 bar	
Zulässige Lastwechsel / Allowable load variation / Variation de charge admissible:		> 2 x 10⁶	

Der unterzeichnende Hersteller bescheinigt hiermit, dass die Baugruppe den Anforderungen der Druckgeräterichtlinie 97/23/EG entspricht.
The undersigned manufacturer certifies that the assembly correspond to the requirements of the pressure equipment directive 97/23/EG.
Le fabricant soussigné confirme, que l'assemblage se correspond aux exigences de la directive des équipements sous pression 97/23/EG

Kategorie der Baugruppe / Assembly denomination / Catégorie d'assemblage:	III		
Konformitätsbewertungsverfahren: Conformity assessment procedure: Procédures d'évaluation de la conformité:	EG-Baumusterprüfung und Konformität der Bauart. CE type examination and conformity of the design. Examen de type CE et conformité de la conception. Modul B + C1		

Die Überwachung erfolgt durch die benannte Stelle:
Monitoring is carried out by a notified center / La surveillance est effectuée par un organisme notifié.

TÜV Industrie Service GmbH, TÜV Süd Gruppe, 80686 München	
Kenn-Nr. / Characteristics-No. / Caractéristiques-N°:	CE 0036
angewandte harmonisierte Normen / Applied harmonized standards / Normes harmonisées appliquées:	---
angewandte sonstige Normen oder techn. Spezifikationen: Other standards or technical specifications applied / Autres normes ou spécifications techniques appliquées:	AD 2000 Regelwerk
angewandte Gemeinschaftsrichtlinien / Applied community guidelines / Lignes directrices appliquées:	---

Anlagen / Attachments / Annexe:

- Beschreibung der Baugruppe und Prüfprotokoll MO-018 / Description of the assembly and test report MO-018 / Description de l'assemblage et rapport d'essais MO-018
- Konformitätserklärung zum Druckspeicher von Fa. HYDAC / Certificate of conformity of the pressure accumulator from the Co. HYDAC / Certificat de conformité de l'accumulateur de pression de la Ste. HYDAC
- Konformitätserklärung zum Sicherheitsventil von Fa. HERION / Certificate of conformity of safety valves from the Co. HERION / Certificat de conformité des soupapes de sécurité de la Ste. HERION
- Konformitätsbescheinigung zum Sicherheitsventil von TÜV Industrie Service / Certificate of conformity to the safety valve of TÜV Industrie Service / Certificat de conformité à la soupape de sécurité du TÜV Industrie Service
- Technische Dokumentation der Baugruppe Gewichtsausgleich (Fa. ÖLHYDRAULIK ALTENERDING) / Technical documentation of the assembly / counterweight (Co. ÖLHYDRAULIK ALTENERDING) / Documentation technique de l'assemblage / contrepoids (Ste. ÖLHYDRAULIK ALTENERDING)
- Technische Dokumentation für Speichersicherheitsventile / Technical documentation for safety valves accumulator / Documentation technique pour l'accumulateur à soupape de sécurité (Fa. / Co. / Ste. HERION)
- Betriebsvorschrift für Einbau und Wartung von Hydrospeicher (Fa. HYDAC) / Instructions for installation and maintenance of Hydraulic accumulators (Co. HYDAC) / Mode d'emploi pour l'installation et maintenance des accumulateurs Hydrauliques (Ste. HYDAC)

Erding, 12.07.12

Herstellerstempel / Stamp of the manufacturer / Tampon du fabricant:

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO.
Postfach 11 52 Tel. (0 81 22) 97 13 - 0
85421 ERDING Fax (0 81 22) 97 13 27

Unterschrift Werkssachverständiger:
Signature Plant expert:
Signature Expert de la plant:



Ausg. 2-9/2002
10.09.2002

ÖLHYDRAULIK ALTENERDING
DECHAMPS & KRETZ GMBH & CO. KG

Verteiler: Original - Kunde, Kopie VK

KONFORMITÄTSERKLÄRUNG
nach Druckgeräterichtlinie 97/23/EGDeclaration of Conformity acc. to Pressure Equipment Directive 97/23/EC
Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CEHYDAC TECHNOLOGY GMBH
Postfach 1251, D-66273 Sulzbach/Saar
Industriegebiet, D-66280 Sulzbach/Saar
Telefon (06897) 509-01
Telefax (06897) 509-454
E-Mail: speichertechnik@hydac.com**Druckbehälter**

Pressure Vessel / Récipient sous pression

Bescheinigung Nr.

Certificate no / N° du Certificat

2012-A / M- 2525

HYDAC Auftrags-Nr.

HYDAC Order no./N° contrat HYDAC

8308107672 / 80**Beschreibung**

Description / Description

Membranspeicher / Diaphragm accumulator / Accumulateur à membrane

Stückzahl

Quantity/Quantité

200**Typ**

Type / Type

SBO330-3,5E1/112UA9-330MF098

Artikel-Nr.

Stock no./Code article

3658960

Baujahr

Year built/Année de fabrication

2012**Seriennummer**

Serial no./N° de série

0851833 bis/to/à 0852032**Zeichnungs-Nr.**

Drawing no./N° de plan

03042029

Index

Index/Indice

d

Rauminhalt (V)

Volume/Volume

3,5**L**

Korrosionszuschlag

Corrosion all./Surépais. de corr.

0**mm****Auslegungsdruck (PD)**

Design pressure/Pression de calcul

330**bar**

Auslegungstemperatur (TD)

Design Temperature/Température de calcul

-40/150**°C****Maximal zulässiger Druck (PS)**

max. permissible Operating Pressure

Pression max de Service admissible

330**bar**

Zulässige minimale/maximale Temperatur (TS)

min/max permissible operating temperature

Température min/max de service admissible

-10/80**°C****Prüfdruck (PT)**

Test pressure / Pression d'épreuve

472**bar**

Kategorie

Category/Catégorie

III

Verwendete Module

Modules followed/Modules utilisés

B + D**Betriebsmedium**

Operating fluid/Fluides admissibles en service

Fluid Gruppe 2 / Fluids in Group 2 / Fluides du Groupe 2

Prüfstelle für

Inspection Authority for/Organisme pour

☐ Entwurfsprüfung

Design Approval/Approbation de Conception

☒ Baumusterprüfung

Type Approval/Approbation de Type

Name

Name/Nom

TÜV Saarland e.V.

Adresse

Address/Adresse

D - 66280 Sulzbach / Saar

Kenn.-Nr.

Ident.no./N° d'identification

0034

Zertifikat-Nr.

Certificate no./N° de Certificat

6020/00/0101-3 Rev. 1

Datum

Date/Date

2004-03-02**Prüfstelle für die Abnahme (Schlussprüfung und Druckprüfung)**

Inspection Authority for final assesement (Final inspection and Proof test)/Organisme pour la vérification finale (Examen final et Epreuve)

Name

Name/Nom

HYDAC Technology GmbH

Adresse

Name/Nom

D - 66280 Sulzbach / Saar

Kenn.-Nr.

Ident.no./N° d'identification

Zertifikat-Nr.

Certificate no./N° de Certificat

Datum

Date/Date

2012-06-22**Prüfstelle für die Zertifizierung des QM-Systems**

Inspection Authority for the certification of the Quality System / Organisme pour l'évaluation du Système Qualité.

Name

Name/Nom

SGS-TÜV GmbH

Adresse

Name/Nom

D - 66280 Sulzbach / Saar

Kenn.-Nr.

Ident.no./N° d'identification

1637

Zertifikat-Nr.

Certificate no./N° de Certificat

71 202 09 Q 0051

Datum

Date/Date

2012-02-29**Der Hersteller, HYDAC Technology GmbH, bescheinigt, daß Konstruktion, Herstellung und Prüfung dieser (dieses) Druckbehälter(s) den Anforderungen der EG-Druckgeräterichtlinie 97/23/EG erfüllen.**

The manufacturer, HYDAC Technology GmbH, certifies that the Design, Manufacture and Inspection of this (these) Pressure Vessel(s) comply with the requirements of the Directive 97/23/EC.

Le Fabricant, HYDAC Technology GmbH, certifie que, la Conception, la Fabrication et l'Inspection du(des) récipient(s) sont conformes aux exigences de la Directive 97/23/CE.

Angewandte Normen und techn. Spezifikationen:Standards and technical specifications used
Normes et spécifications techniques utilisées**AD-2000 Regelwerk****Bemerkungen**

Remarks/Remarques

zul. Druckschwankungsbreite/permissible range of pressure fluctuations/plage d'oscillation de la pression admissible:

bis/bis/jusqu'à **100 °C** $\Delta p = 235 \text{ bar (95-330 bar)}$ bei/for/pour **N = 2.000.000 Lastwechsel/cycles/cycles**

Datum

Date/Date

2012-06-22

Position

Position/Position

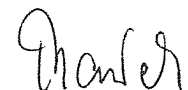
Prüfer

Name

Name/Nom

L.Marszalek**Stempel der Herstellerfirma**Manufacturer's Stamp
Cachet du Fabricant**HYDAC**

HYDAC TECHNOLOGY GMBH



Unterschrift

Signature/signature

Anlagen

Attachments

Documents joints

- Betriebsanleitung / Instruction manual / Manuel d'instruction

- Zeichnung / Drawing / Plan

Übersetzungen zur Konformitätserklärung nach Druckgeräterichtlinie 97/23/EG : Druckbehälter

Translations of the Declaration of Conformity acc. to Pressure Equipment Directive 97/23/CE : Pressure Vessel

Traductions de la Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CE : Réceptier sous pression

1. KONFORMITÁS NYILATKOZAT a 97/23/EG számú, nyomástartó edényekre vonatkozó irányelvek szerint	HU	1. DICHIARAZIONE DI CONFORMITA' secondo Pressure Equipment Directive 97/23/CE	IT	1. DECLARATION OF CONFORMITY acc. to Pressure Equipment Directive 97/23/CE	N
2. Nyomástartó edény Tanúsítvány száma: HYDAC száma Darabszám 3. Megnevezés 4. Típus Cikkszám Gyártási év 5. Sorozatszám 6. Rajzszám Index Térfogat (V) L Korrozíós-pótlék mm 7. Méretezési nyomás (PD) bar Méretezési hőmérséklet (TD) °C 8. Max. Megengedett üzemi nyomás (PS) bar min/max Megengedett üzemi hőmérséklet (TS) °C 9. Próbanomás (PT) bar Kategória Alkalmazott modul 10. Üzemi folyadék 11. Vizsgálat helye Tervrajz vizsgálat Próbavizsgálat 12. Név 13. Jelzőszám Bizonylatszám Dátum 14. Műszaki átvétel helye (végző vizsgálat és nyomáspróba) 15. Név 16. Jelzőszám Bizonylatszám Dátum 17. A QM szerinti műbizonylat kiállításának helye 18. Név 19. Jelzőszám Bizonylatszám Dátum 20. A HYDAC Technology GmbH ezennel igazolja, hogy a fenti nyomástartó edény(ek) konstrukciója, gyártása, vizsgálata és dokumentációja az alkalmazott normák követelményeinek megfelel. 21. Alkalmazott normák 22. Megjegyzések 23. Dátum Pozíció Név 24. A gyártó cég pecsétje 25. Mellékletek Aláírás		2. Recipiente a pressione Certificato no. HYDAC no. Quantità 3. Descrizione 4. Tipo Codice prodotto Anno di costruzione 5. Numero di serie 6. Disegno..Indice..Volume (V)L Sovrappessore di corrosione mm 7. Pressione di progetto (PD) bar Temperatura di progetto (TD) °C 8. Max. Pressione di lavoro ammessa (PS) bar min/max Temperatura di lavoro ammessa (TS) °C 9. Pressione di prova idrostatica(PT)bar Categoria Moduli applicati 10. Fluido di lavoro 11. Ente notificato per ☐ Approvazione del progetto ☐ Approvazione del tipo 12. Nome Indirizzo 13. Identificativo Certificato no. Data 14. Ente notificato per la Verifica finale (Esame finale e Prova) 15. Nome Indirizzo 16. Identificativo Certificato no. Data 17. Ente notificato per la valutazione del Sistema Qualità 18. Nome Indirizzo 19. Identificativo Certificato no. Data 20. HYDAC Technology GmbH certifica che progetto, costruzione, controllo e documentazione di questo/i recipiente/i a pressione sono conformi alle richieste delle Normative applicate. 21. Normativa 22. Note 23. Data Posizione Nome 24. Marcatura del costruttore Firma 25. Allegati		2. Trykk beholder Certificate no. HYDAC no. Antall 3. Beskrivelse 4. Type Material nr. År bygd 5. Serie nr. 6. Tegnings nr. Index Volum (V) L Korrosjonstillatt mm 7. Design trykk (PD) bar Design Temperatur (TD) °C 8. Max. Tillatt arbeids trykk (PS) bar min/max. Tillatt Arbeids Temperatur (TS) °C 9. Test trykk (PT) bar Kategori ☐ Design godkjenning ☐ Type godkjenning 10. Arbeids veske 11. Inspeksjons myndighet for ☐ Design godkjenning ☐ Type godkjenning 12. Navn Adresse 13. Ident. Nr. Sertifikat nr. Dato 14. Inspeksjons myndighet for produksjon, inspeksjon og dokumentasjon 15. Navn Adresse 16. Ident. Nr. Sertifikat nr. Dato 17. Inspeksjons myndighet for evaluering av kvalitet systemet 18. Navn Adresse 19. Ident. Nr. Sertifikat nr. Dato 20. HYDAC Technology GmbH Sertifiserer at, design, produksjon, inspeksjon og dokumentasjon av denne (disse) Trykk beholder(e) er i samsvar med kravene i brukt standard. 21. Standarder brukt 22. Bemerkninger 23. Dato Posisjon Navn 24. Produsentens stempel 25. Vedlegg Signatur	
1. VERKLARING VAN OVEREENSTEMMING volgens de richtlijn drukapparatuur 97/23/EG	NL	1. DEKLARACJA ZGODNOSCI zgodnie z Wytyczną dla Urządzeń Ciśnieniowych 97/23/CE	PL	1. DECLARAÇÃO DE CONFORMIDADE conforme direttriz de vasos pressurizados 97/23/EG (CE)	PT
2. Drukvat Verklaring nr. HYDAC nr. Aantal 3. Beschrijving 4. Type Artikelnr. Bouwjaar 5. Serienummer 6. Tekeningnr. Index Volume (V) L Corrosietoeslag mm 7. Ontwerpdruk (PD) bar Ontwerptemperatuur (TD) °C 8. Max. Toegest. bedrijfsomdruk (PS) bar min/max. Toegest. bedrijfstemperatuur (TS) °C 9. Controledruk (PT) bar Categorie Gebruikte modules 10. Bedrijfsmedium 11. Controledienst voor ☐ Ontwerpkeuring ☐ Constructiekeuring 12. Naam Adres 13. Referentienr. Certificaatnr. Datum 14. Keuringsdienst voor Eindcontrole (Eindinspectie en Beproeving) 15. Naam Adres 16. Referentienr. Certificaatnr. Datum 17. Keuringsdienst voor de certificering van het QM-systeem 18. Naam Adres 19. Referentienr. Certificaatnr. Datum 20. De firma HYDAC Technology GmbH verklaart dat de constructie, fabricage, keuring en documentatie van dit (deze) drukvat(en) overeenkomt met de eisen van de toegepaste normen. 21. Toegepaste normen 22. Opmerkingen 23. Datum Positie Naam 24. Stempel van de fabrikant 25. Bijlagen Handtekening		2. Zbiornik ciśnieniowy Certyfikat nr. HYDAC nr. Ilość 3. Opis 4. Typ Nr artykułu Rok bud. 5. Nr fabr. 6. Rysunek nr Indeks Objętość (V) L Naddatek korozyjny mm 7. Ciśnienie obliczeniowe (PD) bar Temperatura obliczeniowa (TD) °C 8. Maks. ciśn. rob. (PS) bar Min/Maks. temp. rob. (TS) °C 9. Ciśnienie próbne (PT) bar Kategoria Zastosowane moduły 10. Medium robocze 11. Urząd dozorczy dla ☐ Zatwierdzenia projektu ☐ Zatwierdzenia typu 12. Nazwa Adres 13. Nr ident. Certyfikat nr Data 14. Urząd dozorczy dla produkcji, inspekcji i dokumentacji 15. Nazwa Adres 16. Nr ident. Certyfikat nr Data 17. Urząd dozorczy dla certyfikacji systemu zapewnienia jakości 18. Nazwa Adres 19. Nr ident. Certyfikat nr Data 20. Firma HYDAC Technology GmbH zaświadcza, że projekt, produkcja, kontrola i dokumentacja tego (tych) zbiornika(-ów) ciśnieniowego(-ych) zgodna jest z wymogami zastosowanych norm. 21. Zastosowana norma 22. Uwagi 23. Data Pozycja Nazwa 24. Stempel producenta 25. Załącznik Podpis.		2. Vaso de pressão Certificado Nº HYDAC Nº Quantidade 3. Descrição 4. Tipo Artigo Nº Ano de fabr. 5. Nº de série 6. Nº de desenho Index Volume (V)L Acréscimo de corrosão mm 7. Pressão de projeto (PD) bar Temperatura de projeto (TD) °C 8. Max. Pressão operacional permissível (PS) bar min/max. Temperatura operacional permissível (TS) °C 9. Pressão de exame (PT) bar Categoria Módulos utilizados 10. Fluidos operacionais 11. Autoridade de exame para ☐ Exame de projeto ☐ Exame de amostra construtiva 12. Nome Endereço 13. Nº de identif. Nº do certificado Data 14. Autoridade de exame para Verificação final (Exame final e Ensaio) 15. Nome Endereço 16. Nº de identif. Nº do certificado Data 17. Autoridade de exame para a certificação do sistema QM 18. Name Endereço 19. Nº de identif. Nº do certificado Data 20. A Firma HYDAC Technology GmbH certifica que o projeto, a fabricação, o exame e a documentação deste (destes) reservatório(s) de pressão corresponde(m) às exigências das Normas aplicadas. 21. Normas utilizadas 22. Observações 23. Data Posição Nome 24. Carimbo do fabricante 25. Anexos Assinatura	
1. СЕРТИФИКАТ СООТВЕТСТВИЯ согласно Директиве для напорных сосудов 97/23/CE	RUS	1. IZJAVA O SKLADNOSTI z Direktivo o tlačni opremi 97/23/EC	SL	1. FÖRSÄKRAN OM ÖVERENSSTÄMMELSE enligt Tryckkärlsdirektivet 97/23/EG	SV
2. Напорный сосуд Свидетельство № HYDAC № Количество 3. Описание 4. Тип Артикул № Год выпуска 5. Серийный номер 6. Чертеж № Индекс Объем (V)л Припуск на коррозию мм 7. Расчетное давление (PD)бар Расчетная температура (TD)°C 8. Допуст. рабочее давление (PS) бар Допуст. рабочая температура (TS) °C 9. Контрольное давление (PT)бар Категория Используемый модуль 10. Рабочая жидкость 11. Орган контроля для ☐ утверждения проектов ☐ утверждения типов 12. Ф.И.О. Адрес 13. Идентификационный № Сертификат № Дата 14. Орган контроля для производства, контроля и документации 15. Ф.И.О. Адрес 16. Идентификационный № Сертификат № Дата 17. Орган контроля для сертификации систем управления качеством 18. Ф.И.О. Адрес 19. Идентификационный № Сертификат № Дата 20. Фирма HYDAC Technology GmbH удостоверяет, что конструкция, производство, контроль и документация этих (этого) напорных сосудов соответствует требованиям использованных норм. 21. Используемые нормы 22. Примечание 23. Дата Должность Ф.И.О. 24. Печать производителя 25. Приложения Подпись		2. Tlačna posoda Številka certifikata: Številka HYDAC Količina 3. Opis 4. Tip Skladnična št. Leto izdelave 5. Serijska številka 6. Št. Risbe Indeks Volumen (V) Litri Dodatek za korozijo mm 7. Projektiran tlak (PD) bar Projektirana temperatura (TD) °C 8. Max. Dovoljen delovni tlak (PS) bar min/max. Dovoljena delovna temperatura (TS) °C 9. Preizkusni tlak (PT) bar Kategorija Uporabljeni moduli 10. Delovni medij 11. Kontrolno mesto za ☐ Presoja projekta ☐ Presoja vzorca 12. Ime Naslov 13. Identifikacijska št. Št. certifikata Datum 14. Kontrolno mesto za prevzem (dokončna kontrola in tlačni preizkus) 15. Ime Naslov 16. Identifikacijska št. Št. certifikata Datum 17. Kontrolno mesto za certificiranje sistema kvalitete 18. Ime Naslov 19. Identifikacijska št. Št. certifikata Datum 20. Podjetje HYDAC Technology GmbH potrjuje, da konstrukcija, proizvodnja, kontrola in dokumentacija te tlačne posode ustreza uporabljenim standardom. 21. Uporabljeni standardi 22. Opombe 23. Datum Služba Ime 24. Žig proizvajalca 25. Priloge Podpis		2. Tryckkärl Intyg nr. HYDAC nr. Antall 3. Beskrivning 4. Typ Artikel nr. Tillverkningsår 5. Serie nr. 6. Ritning nr. Index Volym (V) L Korrosionstillägg mm 7. Konstruktionstryck (PD) bar Konstruktionstemperatur (TD) °C 8. Max. Tillåtet arbetstryck (PS) bar min/max. Tillåten arbetstemperatur (TS) °C 9. Provtryck (PT) bar Kategori Använd modul 10. Arbetsfluid 11. Anmält organ för ☐ Konstruktionskontroll ☐ Typkontroll 12. Namn Adress 13. Ident. nr. Intyg nr. Datum 14. Anmält organ för Slutkontroll (Slutlig undersökning och Tryckkontroll) 15. Namn Adress 16. Ident. nr. Intyg nr. Datum 17. Anmält organ för kontroll av tillverkarens kvalitetssystem 18. Namn Adress 19. Ident. nr. Intyg nr. Datum 20. HYDAC Technology GmbH intygar att konstruktion, tillverkning, kontroll och dokumentation av detta (dessa) tryckkärl överensstämmer med kraven i angiven föreskrift. 21. Använd föreskrift 22. Påpekande 23. Datum Befattning Namn 24. Tillverkarens stämpel 25. Bilagor Underskrift	

Übersetzungen zur Konformitätserklärung nach Druckgeräterichtlinie 97/23/EG : Druckbehälter

Translations of the Declaration of Conformity acc. to Pressure Equipment Directive 97/23/CE : Pressure Vessel

Traductions de la Déclaration de Conformité suivant la Directive des Equipements sous Pression 97/23/CE : Récipient sous pression

1. Prohlášení o shodě dle směrnice č. 97/23/EG pro tlaková zařízení	CS	1. PROHLÁŠENÍ O SHODĚ podle Směrnice o tlakových zařízeních 97/23/ES	CZ	1. Konformitetserklæring iht. trykbeholderdirektivet 97/23/CE	DA
2. Tlaková nádoba	Osvědčení č. HYDAC č.	2. Tlaková nádoba	Osvědčení č. Čís. zakázky HYDAC	2. Trykbeholder	Certifikat nr. HYDAC nr.
3. Popis	Počet kusů	3. Popis	Počet kusů	3. Tegnelse	Antal
4. Typ	Č. produktu	4. Typ	Čís. výrobku	4. Type	Materiale nr.
5. Č. série	Rok výroby	5. Čís. série	Rok výroby	5. Serie nr.	Produktionsår
6. Výkres č. Index	Objem(V) L	6. Čís. výkresu	Znak	6. Tegnings nr.	Revision
7. Výpočtový přetlak (PD) bar	Přídavek na korozi mm	7. Projektovaný tlak (PD) bar	Obsah (V)	7. Design tryk (PD) bar	Volumen (V) L
8. Max. pracovní přetlak (PS) bar	Výpočtová teplota (TD) °C	8. Maximální přípustný tlak (PS) bar	Přídavek na korozi	8. Max.Tilladeligt arbejdstryk (PS) bar	Korrosionstillæg mm
	min/max. pracovní teplota (TS) °C				Design Temperatur (TD) °C
9. Zkušební tlak (PT) bar	Kategorie	9. Zkušební tlak (PT) bar	Přípustná minimální/maximální teplota (TS) °C	9. Test tryk (PT) bar	min/maxTilladeligt arbejdstemperatur (TS) °C
10. Pracovní látka	Použitý modul	10. Provozní médium		10. Trykmedie	Kategori
11. Zkušební místo pro	☐ Typová zkouška ☐ Stavební zkouška	11. Zkušebna pro	☐ Zkoušení koncepce ☐ Zkoušení typu	11. Inspektør for	☐ design-godkendelse ☐ og type-godkendelse
12. Jméno	Adresa	12. Název	Adresa	12. Navn	Adresse
13. Identifikační č.	Certifikát č.	13. Identifikační číslo	Čís. certifikátu	13. Materiale nr.	Certifikat nr.
14. Zkušební místo pro výrobu, zkoušky a dokumentaci	Datum	14. Zkušebna pro přejímku (závěrečná zkouška a tlaková zkouška)	Datum	14. Inspektør for Afsluttende verifikation (Afsluttende undersøgelse og Trykproevning)	Dato
15. Jméno	Adresa	15. Název	Adresa	15. Navn	Adresse
16. Identifikační č.	Certifikát č.	16. Identifikační číslo	Čís. certifikátu	16. Materiale nr.	Certifikat nr.
17. Zkušební místo pro certifikaci QM - systému	Datum	17. Zkušebna pro certifikaci systému QM	Datum	17. Inspektør for evaluering af kvalitets-sikringsssystem	Dato
18. Jméno	Adresa	18. Název	Adresa	18. Navn	Adresse
19. Identifikační č.	Certifikát č.	19. Identifikační číslo	Čís. certifikátu	19. Materiale nr.	Certifikat nr.
20. Firma Hydac Technology GmbH prohlašuje, že konstrukce, výroba, zkoušky a dokumentace této tlakové nádoby (těchto tlakových nádob) odpovídá požadavkům zavedených norem.		20. Výrobce, HYDAC Technology GmbH, potvrzuje, že konstrukce, výroba a zkoušení této tlakové nádoby (těchto tlakových nádob) splňuje požadavky směrnice EU o tlakových nádobách 97/23/ES.		20. HYDAC Technology GmbH certifikat for, design, fremstilling, inspektion og dokumentation af denne/disse trykbeholder(e) i henhold til de anvendte standarder.	
21. Použité normy		21. Uplatněné normy a technické specifikace:		21. Anvendt standard	
22. Poznámky		22. Poznámky		22. Bemærkninger	
23. Datum	Pozice	23. Datum	Funkce	23. Dato	Position
24. Razítko výrobce	Jméno	24. Razítko výrobní firmy	Jméno	24. Producent stempel	Navn
25. Přílohy	Podpis	25. Přílohy	Podpis	25. Bilag	Underskrevet
1. KONFORMITÄTserklärung nach Druckgeräterichtlinie 97/23/EG	DE	1. ΔΗΛΩΣΗ ΣΥΜΜΟΡΦΩΣΗΣ βάσει ντερεκτίβας μηχανών πίεσης 97/23/ΕΟΚ	EL	1. DECLARATION OF CONFORMITY according to Pressure Equipment Directive 97/23/EC	EN
2. Druckbehälter	Bescheinigung Nr. HYDAC Auftrags-Nr.	2. Δεξαμενή πίεσης	No. Βεβαίωσης No. HYDAC	2. Pressure vessel	Certificate no. HYDAC Order no.
3. Beschreibung	Stückzahl	3. Περιγραφή	Τιμή	3. Description	Quantity
4. Type	Artikel-Nr.	4. Μοντέλο	No. είδους	4. Type	Stock no.
5. Seriennummer	Baujahr	5. Σειριακός αριθμός	Ετος κατασκευής	5. Serial no.	Year of manufacture
6. Zeichnungs-Nr. Index	Rauminhalt (V) L	6. No. σχεδίου	Λίστα Όγκος (V) L	6. Drawing no. Index	Volume (V) Litre
7. Auslegungsdruk (PD) bar	Korrosionszuschlag mm	7. Κατασκευαστική πίεση (PD) bar	Κατασκευαστική θερμοκρασία (TD) °C	7. Design Pressure (PD) bar	Corrosion allowance mm
8. Maximal zulässiger Druck (PS) bar	Zuässige minimale/maximale Temperatur (TS) °C	8. Επιτρ. υπερπίεση (PS) bar	Επιτρ. θερμοκρασία λειτουργίας (TS) °C	8. Max Permissible Operating Pressure (PS) bar	Design Temperature (TD) °C
9. Prüfdruck (PT) bar	Kategorie	9. Πίεση τεστ (PT) bar	Κατηγορία	9. Test Pressure (PT) bar	Category
10. Betriebsmedium	Verwendete Module	10. Υλ./μέσον λειτουργίας	Χρησιμοποιηθέντα μοντούλ	10. Operating Fluid	Modules followed
11. Prüfstelle für	☐ Entwurfsprüfung ☐ Baumusterprüfung	11. Υπηρεσία ελέγχου για	☐ Ελεγχος σχεδίου ☐ Ελεγχος σχεδίου	11. Inspection Authority for	☐ Design Approval ☐ Type Approval
12. Name	Adresse	12. Ονομα	Διεύθυνση	12. Name	Address
13. Kenn.-Nr.	Zertifikat-Nr.	13. Διακριτικός αριθμός	No. Πιστοποιητικού	13. Ident. No.	Certificate no.
14. Prüfstelle für die Abnahme (Schlussprüfung und Druckprüfung)	Datum	14. Υπηρεσία ελέγχου κατασκευής, ελέγχου και τεκμηρίωσης	Ημερομηνία	14. Inspection Authority for final assessment (Final inspection and Proof test)	Date
15. Name	Adresse	15. Ονομα	Διεύθυνση	15. Name	Address
16. Kenn.-Nr.	Zertifikat-Nr.	16. Διακριτικός αριθμός	No. Πιστοποιητικού	16. Ident. No.	Certificate no.
17. Prüfstelle für die Zertifizierung des QM-Systems	Datum	17. Υπηρεσία ελέγχου πιστοποίησης του συστήματος μόνταζης ποιότητας	Ημερομηνία	17. Inspection Authority for the certification of the Quality System	Date
18. Name	Adresse	18. Ονομα	Διεύθυνση	18. Name	Address
19. Kenn.-Nr.	Zertifikat-Nr.	19. Διακριτικός αριθμός	No. Πιστοποιητικού	19. Ident. No.	Certificate no.
20. Der Hersteller, HYDAC Technology GmbH, bescheinigt, daß Konstruktion, Herstellung und Prüfung dieser (dieses) Druckbehälter(s) den Anforderungen der EG-Druckgeräterichtlinie 97/23/EG erfüllen.		20. Η εταιρία HYDAC Τεχνολογίας Ε.Π.Ε. βεβαιώνει ότι, ο σχεδιασμός, η κατασκευή, ο έλεγχος και η τεκμηρίωση της/των δεξαμενής/ών πίεσης ανταποκρίνεται/ονται στις απαιτήσεις των εφαρμοστέων προδιαγραφών.		20. The manufacturer, HYDAC Technology GmbH, certifies that the Design, Manufacture and Inspection of this (these) Pressure Vessel(s) comply with the requirements of the Directive 97/23/EC.	
21. Angewandte Normen und techn. Spezifikationen		21. Εφαρμοστές προδιαγραφές		21. Standards and tech. Specifications used	
22. Bemerkungen		22. Σημειώσεις		22. Remarks	
23. Datum	Position	23. Ημερομηνία	Βαθμός	23. Date	Position
24. Stempel der Herstellerfirma	Name	24. Σφραγίδα κατασκευαστικής εταιρίας	Όνομα	24. Manufacturer's Stamp	Name
25. Anlagen	Unterschrift	25. Εσώκλειστα	Υπογραφή	25. Attachments	Signature
1. DECLARACIÓN DE CONFORMIDAD de acuerdo a la Directiva 97/23/CE para Aparatos a Presión.	ES	1. Paineilaidedirektiivini 97/23/EY mukainen VAATIMUSTENMUKAISUUSVAKUUTUS	FI	1. DECLARATION DE CONFORMITE suivant la Directive des Equipements sous Pression 97/23/CE	FR
2. Aparatos a presión	No. de Certificado No. HYDAC	2. Paineilaite	Todistusnumero HYDAC numero	2. Récipient sous pression	N° du Certificat N° contrat HYDAC
3. Descripción	Cantidad	3. Kuvaus	Määrä	3. Description	Quantité
4. Tipo	No. de material	4. Tyypit	Artikkelinumero	4. Type	Code Article
5. No. de fabricación	Año de fabricación	5. Sarjanumero	Valmistusvuosi	5. N° de Série	Année de Fabrication
6. No. del Dibujo	Index Volumen (V) L	6. Piirustusnumero	Indeksi Tilavuus (V) l	6. N° de Plan	Indice Volume (V) L
7. Presión de diseño (PD) bar	Factor de corrosión mm	7. Suunnittelupaine (PD) bar	Suunnittelulämpötila (TD) °C	7. Pression de Calcul (PD) bar	Temperatura de Calcul (TD) °C
8. Presión max. de servicio permitida (PS) bar	Temperatura min/max de servicio permitida (TS) °C	8. Max. Sallittu käyttöpaine (PS) bar	min/maxSallittu käyttölämpötila (TS) °C	8. Pression max. de Service Admissible (PS) bar	Temperature min/max de Service Admissible (TS) °C
9. Presión de ensayo (PT) bar	Kategorie	9. Koepaine (PT) bar	Kategoria	9. Pression d'Epreuve (PT) bar	Categorie
10. Fluido de servicio	Módul utilizado	10. Käyttöaine	Sovelletut moduulit	10. Fluides admissibles en service	Module utilisé
11. Autoridad de Inspección para la	☐ aprobación del Diseño ☐ aprobación a tipo muestra	11. Vastaava tarkastuslaitos	☐ Suunnittelmatarkastus ☐ Tyypitarkastus	11. Organisme pour	☐ Approbation de Conception ☐ Approbation de Type
12. Nombre	Dirección	12. Nimi	Osoite	12. Nom	Adresse
13. No. de Ident.	No. de Certificado	13. Tarkastuslaitoksen numero	Sertifikaattinumero	13. N° d'identification	N° de Certificat
14. Autoridad de Verificación final (Inspección final y Prueba)	Fecha	14. Vastaava tarkastuslaitos	Lopputarkastus (Loppukoe, Koeponnistus)	14. Organisme pour la Vérification finale (Examen final et Epreuve)	Date
15. Nombre	Dirección	15. Nimi	Osoite	15. Nom	Adresse
16. No. de Ident.	No. de Certificado	16. Tarkastuslaitoksen numero	Sertifikaattinumero	16. N° d'identification	N° de Certificat
17. Autoridad de Inspección para la evaluación del Sistema de Calidad	Fecha	17. Laatujärjestelmän sertifiointista vastaava tarkastuslaitos	Päiväys	17. Organisme pour l'évaluation du Système Qualité	Date
18. Nombre	Dirección	18. Nimi	Osoite	18. Nom	Adresse
19. No. de Ident.	No. de Certificado	19. Tarkastuslaitoksen numero	Sertifikaattinumero	19. N° d'identification	N° de Certificat
20. HYDAC Technology GmbH certifica que el diseño, la manufactura, la inspección y la documentación de este(os) aparato(s) a presión cumplen con los requerimientos de las normas utilizadas.		20. HYDAC Technology GmbH vakuuttaa, että näiden paineasteiden rakenne, valmistus, tarkastus ja dokumentointi vastaavat sovellettavien standardien vaatimuksia.		20. Le fabricant, HYDAC Technology GmbH, certifie que, la Conception, la Fabrication et l'inspection du(des) récipient(s) sont conformes aux exigences de la Directive 97/23/CE	
21. Normas utilizadas		21. Sovellettavat standardit		21. Normes et spécifications techniques utilisées	
22. Comentarios		22. Huomioitavaa		22. Remarques	
23. echa	Posición	23. Päiväys	Tehtävä yrityksessä	23. Date	Position
24. Sello de la Firma manufacturadora	Nombre	24. Valmistajan leima	Nimi	24. Cachet du Fabricant	Nom
25. Apéndice	Signatura	25. Liitteet	Allekirjoitus	25. Documents joints	Signature

Bestätigung

Die Zertifizierungsstelle für QS-Systeme nach DGRL 97/23/EG der SGS-TÜV GmbH – ein Unternehmen der SGS-Gruppe und des TÜV Saarland e.V. - bestätigt, dass sich die Kenn-Nummer der Benannten Stelle mit Übergang der Zulassung vom TÜV Saarland e.V. auf die SGS-TÜV GmbH von der 0034 auf die 1637 geändert hat. Dies gilt seit 01.04.2009.

Die Zertifizierungsstelle für QS-Systeme (Benannte Stelle mit der Kenn-Nr. 1637) akzeptiert als Nachfolgeorganisation des TÜV Saarland e.V. (Benannte Stelle mit der Kenn-Nr. 0034) für eine Übergangszeit mit der Laufzeit des Zertifikates (Zertifikat-Nr. 71 202 A 001) die Verwendung der Kennzeichnung der Produkte mit der Kenn-Nr. 0034 zusammen mit der Konformitätserklärung nach DGRL 97/23/EG Modul H1. Die Konformitätsbewertung unter der Kenn-Nr. 1637 muss den Verweis auf die Kennzeichnung des Produktes mit 0034 beinhalten.

Für weitere Fragen stehen Ihnen Herr Dr. Brendel (0170 7634043) und Herr Dietz (0174 3009138) gerne zur Verfügung.

Confirmation

The Certification Body for QS Systems based on the standard PED 97/23/EG of the SGS-TÜV GmbH, a company belonging to the SGS group and the TÜV Saarland e.V., hereby confirms that the no. of the Notified Body changed from 0034 to 1637 as the accreditation was passed from the TÜV Saarland e.V. on to the SGS-TÜV GmbH, with date of 01.04.2009.

The Certification Body for QS Systems (that is to say, the Notified Body no. 1637, the successor organization of the TÜV Saarland e.V. which was the Notified Body before with no. 0034, as indicated above) is disposed to accept that during the remaining time of validity of the certificate no. 71 202 A 001 the products can get labelled with the number 0034, but need to be accompanied by a declaration of conformity based on PED 97/23/EG module H1. It is required that the evaluation of conformity carried out by no. 1637 does contain a reference to the product labelling with number 0034.

For any further questions in this regard, please feel free to contact Mr. Brendel (mobile: 0170-7634043) or Mr. Dietz (mobile: 0174-3009138).

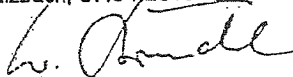
Attestation

L'Office de certification des Systèmes Assurance Qualité selon la Directive équipements sous pression 97/23/EG de SGS-TÜV GmbH - une société du groupe SGS et du TÜV Saarland e.V. - atteste que le n° de marquage de l'organisme notifié a été modifié de 0034 à 1637, suite à la transition de l'accréditation de TÜV Saarland e.V. à SGS-TÜV GmbH, ceci à partir du 01.04.2009.

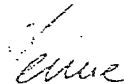
L'Office de certification des Systèmes Assurance Qualité (organisme notifié avec le n° 1637) accepte, à titre d'organisme successeur du TÜV Saarland E.V. (organisme notifié avec le n° 0034) pour une période transitoire de la durée du certificat (certificat n° 71 202 A 001), l'utilisation du marquage des produits avec le n° 0034 conjointement avec une attestation de conformité selon Directive 97/23/EG module H1. L'évaluation de la conformité sous le n° 1637 doit contenir la référence du marquage du produit 0034.

Pour tout renseignement complémentaire, veuillez vous adresser à M. Brendel (+49 170 7634043) ou M. Dietz (+49 174 3009138).

Sulzbach, 07.04.2010



i.V. Dr. Wolfgang Brendel
Leiter Zertifizierungsstelle für QS-Systeme



i.A. Dr. Hagen Senne
QMB SGS-TÜV GmbH

1. Allgemeine Hinweise

1.1 Zielgruppen

Diese Betriebsanleitung richtet sich an Fachpersonal.

Dieses Personal

- ist für den Einbau des Speichersicherheitsventils geschult,
- kennt die allgemeine Sicherheitshinweise im Zusammenhang mit der Bedienung und Wartung der Maschine, wo das Ventil eingebaut wird,

- kennt den Inhalt dieser Betriebsanleitung

2. Geräte- Beschreibung

2.1 Bestimmungsgemäße Verwendung

Das Speichersicherheitsventil ist ausschließlich dazu bestimmt:

- zur Absicherung des Hydraulikspeichers gegen Drucküberschreitung

Für andere als die hier aufgeführten Verwendungsarten ist das Speichersicherheitsventil nicht bestimmt. Das gilt als sachwidrige Verwendung!

2.2 Aufbau

- siehe HS- Druckschrift 7501406.05.03.96

2.3 Funktion

- siehe HS- Druckschrift 7501406.05.03.96

2.4 Technische Daten

- siehe HS- Druckschrift 7501406.05.03.96

3. Allgemeine Sicherheitshinweise

3.1 Sorgfaltspflicht des Betreibers

Das Speichersicherheitsventil wurde unter Berücksichtigung einer Gefährdungsanalyse und nach sorgfältiger Auswahl der einzuhaltenden harmonisierten Normen, sowie weiterer technischer Spezifikationen konstruiert und gebaut. Er entspricht damit dem Stand der Technik und gewährleistet ein Höchstmaß an Sicherheit.

Diese Sicherheit kann in der betrieblichen Praxis jedoch nur dann erreicht werden, wenn alle dafür erforderlichen Maßnahmen getroffen werden. Es unterliegt der Sorgfaltspflicht des Betreibers, diese Maßnahmen zu planen und ihre Ausführung zu kontrollieren.

Der Betreiber muß insbesondere sicherstellen, daß

- das Speichersicherheitsventil nur bestimmungsgemäß verwendet wird (vgl. hierzu Kapitel Produktbeschreibung),
- das Speichersicherheitsventil nur in einwandfreiem, funktionsfähigem Zustand betrieben wird,
- erforderliche persönliche Schutzausrüstungen für das Bedienungspersonal zur Verfügung stehen und benutzt werden,
- die Betriebsanleitung stets in einem leserlichen Zustand und vollständig zur Verfügung steht,
- das Ventil nur von ausreichend qualifizierten und autorisierten Personal eingebaut und gewartet
- dieses Personal regelmäßig in allen zutreffenden Fragen von Arbeitssicherheit und Umweltschutz unterwiesen wird, sowie die Betriebsanleitung und insbesondere die darin enthaltenen Sicherheitshinweise kennt,

Technische Dokumentation für Speichersicherheitsventile

HERION Systemtechnik GmbH
Postfach 1269
71256 Weil der Stadt
Tel. 07033/3018-0
Fax 07033/3018-10

Inhalt:

1. Allgemeine Hinweise
 - 1.1 Zielgruppen
2. Beschreibung
 - 2.1 Bestimmungsgemäße Verwendung
 - 2.2 Aufbau
 - 2.3 Funktion
 - 2.4 Technische Daten
3. Allgemeine Sicherheitshinweise
 - 3.1 Sorgfaltspflicht des Betreibers
 - 3.2 Verwendete Sicherheitssymbole
 - 3.3 Sterilen
 - 3.4 Normalbetrieb
 - 3.5 Hydraulik
 - 3.6 Umweltschutz
 - 3.7 Veränderungen am Gerät
 - 3.8 Thermische Gefährdungen
4. Inbetriebnahme
 - 4.1 Allgemeine Hinweise
5. Hilfe bei Störungen
 - 5.1 Allgemeine Hinweise
6. Wartung und Instandhaltung
 - 6.1 Allgemeine Hinweise
 - 6.2 Sicherheitshinweise zur Wartung und Instandhaltung
 - 6.3 Wartungsintervalle
 - 6.4 Drivara Druckkontrollen
 - 6.5 Allgemeine Hinweise zur Instandsetzung
 - 6.6 Werkmittel
7. Anhang
 - 7.1 EG-Konformitätserklärung
 - 7.2 Deklarierter-Speichersicherheitsventil

- alle am Speichersicherheitsventil angebrachten Sicherheits- und Warnhinweise nicht entfernt werden und lesertüchtig bleiben,
- das Bedienungspersonal über das Verhalten bei Störfällen geschult wird.

3.2 Verwendete Sicherheitssymbole

In der vorliegenden Betriebsanleitung werden die folgenden Sicherheitssymbole verwendet.
Diese Symbole sollen den Leser vor allem auf den Text des nebensiehenden Sicherheitshinweises aufmerksam machen.



Gefahr!

Dieses Symbol weist darauf hin, daß Gefahren für Leben und Gesundheit von Personen bestehen.



Achtung!

Dieses Symbol weist darauf hin, daß Gefahren für Maschine, Material oder Umwelt bestehen.



Hinweis!

Dieses Symbol kennzeichnet Informationen, die zum besseren Verständnis der Bedienungsabläufe beitragen

3.3 Starten

Vor jedem Start sind folgende Tätigkeiten durchzuführen:

- das Speichersicherheitsventil auf sichtbare Schäden überprüfen; festgestellte Mängel dem Aufsichtspersonal melden - das Speichersicherheitsventil darf nur in einwandfreiem Zustand betrieben werden,
- Alle Gegenstände und sonstigen Materialien, die nicht für den Betrieb benötigt werden, sind aus dem Arbeitsbereich des Speichersicherheitsventils zu entfernen.

3.4 Normalbetrieb

- Während des Betriebes des Speichersicherheitsventils dürfen keine Sicherheitsvorrichtungen entfernt oder außer Funktion gesetzt werden.
- Das Bedienungspersonal hat darauf zu achten, daß sich keine unbefugten Personen im Arbeitsbereich des Speichersicherheitsventils aufhalten.
- Einmal täglich sind folgende Kontrolltätigkeiten auszuführen:
 - das Speichersicherheitsventil auf äußerlich erkennbare Schäden und auf Dichtheit überprüfen

3.5 Hydraulik

Umgang mit Hydrauliköl

Bei Arbeiten an der Speichereinlage besteht die Gefahr, daß Flüssigkeit unter hohem Druck heraus spritzen kann.



- Augenschutz: Beim Einsatz geeignete Schutzbrille tragen!
- Dampf und Nebel nicht einatmen!
- Hautkontakt: Schutzhandschuhe tragen
- Einnahme: Nahrungsmittel fernhalten!
Nicht am Arbeitsplatz essen!



- Verspritztes Hydrauliköl sofort aufsaugen!
- Geeignetes Schuhwerk tragen! Rutschgefahr!
- Hautkontakt: Schutzhandschuhe tragen

Maßnahmen bei Unfällen:



Gefahr!

- Augenkontakt
Augen mindestens 15 Minuten lang mit Wasser spülen
- Hautkontakt
Haut mit Wasser und Seife abwaschen
Kleidung waschen
- Einnahme
Kein Erbrechen auslösen, sondern Arzt aufsuchen



Hinweis!

- Während des Betriebes auf Leckagen beobachten!
- Leckagen sofort dem Wartungspersonal melden!

3.6 Umweltschutz

Bei allen Arbeiten am Speichersicherheitsventil sind die Vorschriften zur Abfallvermeidung und zur ordnungsgemäßen Abfallverwertung bzw. -Beseitigung einzuhalten.

3.7 Veränderungen am Speichersicherheitsventil

Am Speichersicherheitsventil dürfen aus Sicherheitsgründen keine eigenmächtigen Veränderungen vorgenommen werden. Alle geplanten Veränderungen müssen von der Firma Herion-Systemtechnik schriftlich genehmigt werden.

3.8 Thermische Gefährdungen



Gefahr!

- Bei Arbeiten am Ventil besteht die Gefahr von Verbrennungen durch
 - Kontakt mit heißem Hydrauliköl
 - Kontakt mit erwärmtem Gerät

4. Inbetriebnahme

4.1 Allgemeine Hinweise

Einbaubohrung: siehe HS-Druckschrift 7501406

5. Hilfe bei Störungen

5.1 Allgemeine Hinweise

Bedienpersonal benachrichtigen

6. Wartung und Instandhaltung

6.1 Allgemeine Hinweise

6.1.1 Hydraulik-Inspektion

Bei Speichersicherheitsventilen ist die Aneuprüfung, in der Öl abgeführt wird für die Lebensdauer bestimmend. Diese Zeit ist im allgemeinen schwer zu bestimmen. Auf der sicheren Seite ist man hierbei, wenn nach ca. 30 Anspruchsjahren oder max. nach 5 Jahren die Ventile auf Dichtheit überprüft werden.

6.1.2 Kontrolle des Zustandes des Speichersicherheitsventils

Die Einstellung auf den Maximaldruck erfolgt im Werk. Gegen unbefugtes Verstellen auf einen anderen Druck wird die Abdeckhaube plombiert. Es wird regelmäßig kontrolliert, ob das nicht beschädigt oder entfernt ist.

6.1.3 Fristen

Vorgeschriebene oder in Betriebsanleitung angegebene Fristen für wiederkehrende Prüfungen/Inspektionen einhalten!

6.1.4 Werkstattaufrüstung

Zur Durchführung von Instandhaltungsmaßnahmen ist eine den Arbeiten angemessene Werkstattaufrüstung unbedingt notwendig.

6.2 Sicherheitshinweise zur Wartung und Instandhaltung

- lpt. Anlage auf Zimmertemperatur abkühlen
- Anlage muss drucklos sein.



Gefahr!



Achtung!

Vor Öffnung von Anschlüssen: Möglichkeit zum Auffangen des Hydrauliköls schaffen



Gefahr!

Plomben an Geräten dürfen nicht entfernt werden.

6.3 Wartungsintervalle

Hinweis: Die Zeitintervalle sind Vorschläge, die sich je nach Betriebsbedingungen ändern können.

Lfd. Nr. Durchzuführende Arbeiten

Zeitintervall

1. Geräte auf Beschädigung und Dichtheit kontrollieren

wöchentlich

6.4 Druck- Kontrollen



Achtung!

- Auf ungewöhnliche Druckschwankungen achten.
- Auf abweichende Anzeigen gegenüber den Einstellwerten achten.

6.5 Allgemeine Hinweise zur Instandsetzung

6.5.1 Dokumentationsunterlagen für Instandsetzungsarbeiten:

Siehe unter

Punkt 7.2 Teile-Dokumentation

6.5.2 Allgemeine Sicherheitshinweise zur Instandsetzung

- Allgemeine Sicherheitshinweise gemäß 6.2 beachten!

Vormeldung von Umwelt Schäden durch Mineralöl!

Hinweis: Das Gerät ist während der Inbetriebnahme und in regelmäßigen Abständen auf Dichtheit zu überprüfen.

Achtung! Eventuell anfallendes Aböl bei Reparaturen muß in geeigneten Behältern aufgefangen werden.

Für sichere und umweltchonende Entsorgung von Betriebs- und Hilfsstoffen sowie Austauschteilen sorgen!

6.5.3 Demontage und Wiedermontage

- Vor Demontagearbeiten ist die Anlage grundsätzlich spannungslos zu schalten.
- Montagearbeiten an den Geräten dürfen erst nach Ablassen des Flüssigkeitsvolumens und des Flüssigkeitsvolumens durchgeführt werden.
- Es dürfen keine Geräte gelöst werden, solange das System unter Druck steht.
- Jede Öffnung ist auf größte Sauberkeit der Umgebung zu achten.
- Zum Reinigen kein Putzmittel verwenden.
- Beim Abwaschen mit Lösungsmitteln darf nichts in das Innere des Systems gelangen.
- Keine mechanischen Bearbeitung am System durchführen, bei der Späne in das Innere gelangen können.

6.5.4 Hinweise zu kundenseitigen Reparaturen

Nach dem Demontieren von Speichersicherheitsventilen bzw. nach Wartungsarbeiten, bei denen Öl abgelassen wurde, müssen Maßnahmen für eine erneute Inbetriebnahme vorgenommen werden.



Achtung!

Erneute Inbetriebnahme

Diese Maßnahmen müssen sehr sorgfältig und nur von geschultem Personal durchgeführt werden. HS weist darauf hin, daß nach Eingriffen in das Gerät durch den Betreiber die Gewährleistung von HS erlischt

6.6 Meßmittel

Drehmomentachtiltaso)

Diese ist als Meßmittel zu betrachten und unterliegt somit der Meßmittelüberwachung des Betreibers.



**Systemtechnik
GmbH**

HERION Systemtechnik GmbH
Postfach 1269, D-71256 Weil der Stadt
Untere Talstrasse 65, D-71263 Weil der Stadt
Tel.: +49 70 33 / 30 18-0 Fax: +49 70 33 / 30 18-10

Declaration of Conformity / Konformitätserklärung

in acc. to the pressure equipment directive 97/23/EC
nach Druckgeräterichtlinie 97/23/EG



type* Typ*	nominal size Nennweite	EC-type examination no. EG-Baumusterprüfnummer	type-test-no. Bauteilprüfnummer
DBC 6 HKE 017	6	01 202 2 046 02 60100	527
DBC 6 HKE 002	6	01 202 2 046 02 60100	942
DBC 6 XE 002	6	01 202 2 046 02 60100	942
DBC 10 HKE 017	10	01 202 2 046 02 60100	620

description of the pressure equipment / Beschreibung des Druckgerätes

* see name plate / siehe Typenschild

category IV

applied category in acc. to article 3 and annex II / angewandte Kategorie nach Artikel 3 und Anhang II

module / Modul	conformity assessment procedures / Konformitätsbewertungsverfahren	certificate number / Bescheinigungsnummer
B	EC type-examination / EG-Baumusterprüfung	01 202 2 046 02 60100
F	inspection of the products / Prüfung der Produkte	see conformity certificate / siehe Konformitätsbescheinigung

conformity assessment procedures in acc. to article 10 / angewandte Konformitätsbewertungsverfahren nach Artikel 10

module / Modul B: TÜV CERT - Zertifizierungsstelle für Druckgeräte des RWTÜV e. V.

identification number: 0044, Langemarckstraße 28, D-45141 Essen / Germany

name and address of the notified body (monitoring a.m. conformity assessment procedures)

Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

module / Modul F: TÜV CERT - Zertifizierungsstelle für Druckgeräte des TÜV-Süd Deutschland Bau und Betrieb GmbH

identification number: 0036, Gottlieb-Daimler-Str. 7, D-70794 Filderstadt / Germany

name and address of the notified body (monitoring a.m. conformity assessment procedures)

Name und Anschrift der benannten Stelle (Zertifizierung / Überwachung nach o.g. Modulen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment is in accordance to the requirements of the pressure equipment directive.

Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entspricht.

at the moment no harmonized standards available

zur Zeit keine harmonisierten Normen verfügbar

applied harmonized standards / angewandte harmonisierte Normen

AD-Merkblatt 2000 A2, TRD 801 Nr. 45

other applied standards or technical rules / angewandte andere Normen oder technische Spezifikationen

25.02.02

date

Herion-Systemtechnik GmbH

Untere Talstr. 65, 71263 Weil der Stadt

manufacturer stamp

Th. Quenel



authorized subscriber

Sitz der Gesellschaft: Weil der Stadt - Registergericht: Amtsgericht Leonberg HRB 2734
Geschäftsführer: Hans-Jochen Eifmert

ABN AMRO Bank Frankfurt
BLZ 502 304 00, Kto.-Nr. 18 09 166 004
SWIFT-Code: ABNADE33
IBAN: DE44 5003 0000 0000 0000 00

Landesbank Baden-Württemberg
BLZ 600 501 01, Kto.-Nr. 222 44 06
SWIFT-Code: LAGID633

Ein Unternehmen der IMI-Gruppe



HYDAC
Technology GmbH
Postfach 1251
D-66273 Sulzbach/Saar
Industriegebiet
D-66280 Sulzbach/Saar
Telefon: 0 68 97 / 5 09-01
Telefax: 0 68 97 / 5 09-454
Telex: 4 429 331

Hydrospeicher Betriebsvorschrift für Einbau und Wartung

Hydraulic Accumulator Fitting and Maintenance Instructions

Accumulateurs Hydrauliques Instructions de montage et d'entretien

Für Hydrospeicher sind die Aufstellungsort geltenden Vorschriften vor Inbetriebnahme und während des Betriebes zu beachten. In der Bundesrepublik Deutschland unterliegen diese der Druckbehälterverordnung (DruckbehV).

Am Speicherkörper dürfen weder Schweiß- noch Lötarbeiten und keinerlei mechanische Arbeiten vorgenommen werden. Arbeiten an Anlagen mit Speichern (Reparaturen, Anschließen von Manometern u. ä.) dürfen erst nach Ablassen der Druckflüssigkeit ausgeführt werden. Nach dem Anschließen der Hydraulikleitung ist diese vollständig zu entlüften.

Neue oder instandgesetzte Speicher müssen vor Inbetriebnahme mit Stickstoff aufgeladen werden.

Niemals Sauerstoff oder Luft verwenden! Explosionsgefahr! Wird der Speicher bereits mit dem gewünschten Gasfülldruck geladert, so ist die Druckhöhe aus der Kennzeichnung zu erhöhen. Gas- und Ölventilhaltemutter nach der Inbetriebnahme nachziehen (Anzugsdrehmoment lt. Reparaturanleitung verwenden). *

Defekte Gasventile dürfen nur durch original HYDAC-Teile ersetzt werden! Grenzen des Gasfülldruckes und Betriebstemperatur beachten!

Warnhinweis: Bedingt durch Permeation oder einen Defekt der Blase, der Membrane oder der Kolbendichtung tritt beim Füllen oder Prüfen des Speichers Stickstoff und Betriebsflüssigkeit aus. **ACHTUNG:** Gesundheitsgefahr bei aggressiven Medien! (Sonderfüll- und Prüfvorrichtung auf Anfrage)

Warnhinweis: Bedingt durch Permeation oder einen Defekt der Blase, der Membrane oder der Kolbendichtung kann sich Stickstoff in der Druckflüssigkeit lösen. Beim Entlasten auf niedrigeren Druck löst sich das Gas schlagartig aus der Flüssigkeit und dehnt sich dabei aus. Diese Tatsache ist bei der Auslegung von angeschlossenen Bauteilen wie Tanks, Filter usw. zu beachten.

* gilt nur für Blasenspeicher

Prior to commissioning and during operation, the regulations relating to hydraulic accumulators which are in force in the country of installation must be adhered to.

In the Federal Republic of Germany, hydraulic accumulators are subject to the Pressure Vessels Regulations (DruckbehV).

On no account should welding, soldering or any mechanical work be carried out on the accumulator shell. Work on systems with accumulators (repairs, connection of pressure gauges etc.) should only be carried out once the pressure fluid has been drained out. Once the hydraulics have been connected, all air should be completely vented.

New or repaired accumulators must be charged with nitrogen prior to commissioning.

Never use oxygen or air! Danger of explosion! If the accumulator is supplied already pre-charged with the required gas charging pressure, the pressure is marked.

After commissioning, tighten gas and oil valve lock nut (use torque given in repair instructions). *

Defective gas valves must only be replaced with original HYDAC parts! The limits of gas charging pressure and operating temperature must be taken into account.

Warning: Due to permeation or a defect in the bladder, diaphragm or piston seal, nitrogen and operating fluid may escape when charging or testing the accumulator.

IMPORTANT: Health risks when aggressive media are used! (Special charging and testing unit available on request)

Warning: Due to permeation or a defect in the bladder, diaphragm or piston seal, nitrogen can dissolve in the operating fluid. When releasing pressure, the gas is suddenly released from the fluid and expands. This must be taken into account when sizing connected components such as tanks, filters etc.

* applies only to bladder accumulators

Les accumulateurs
hydrauliques sont soumis à la réglementation en vigueur au lieu d'installation et ceci avant et après leur mise en service. En France les appareils à pression de gaz sont soumis au Décret Ministériel du 18 janvier 1973, aux Arrêtés Ministériels du 05 janvier 1978, du 24 mars 1978 et du 24 novembre 1982.

Il est interdit d'effectuer des travaux de soudure, de brasure ou d'autres interventions mécaniques sur le corps de l'accumulateur.

Il est impératif de procéder à la vidange complète de l'accumulateur lors d'une intervention sur une installation. Le système hydraulique doit être intégralement purgé après raccordement à la tuyauterie.

Les accumulateurs neufs ou ceux remis en état doivent être remplis avec de l'azote avant leur mise en service.

Ne jamais utiliser d'oxygène ou d'air! Danger, risques d'explosion. Lorsque l'accumulateur est livré avec la pression de gonflage souhaitée, celle-ci est mentionnée sur la plaque signalétique.

Resserrer l'écrou de maintien de la vessie et de la bouche hydraulique après gonflage en azote de l'accumulateur (couple de serrage: voir notice de maintenance)

Les valves de gaz défectueuses doivent être remplacées par des pièces d'origine HYDAC.

Respecter les limites de pression de gonflage et de températures de service.

Avertissement:

En raison de la perméabilité de l'élastomère ou d'un défaut d'étanchéité de la vessie, de la membrane ou du piston, de l'azote et du fluide de service peuvent s'échapper lors du gonflage ou du contrôle de l'accumulateur.

ATTENTION: Dangers pour la santé avec les fluides agressifs! (Dispositif de gonflage et de contrôle spécial sur demande)

Avertissement:

En raison de la perméabilité de l'élastomère ou d'un défaut d'étanchéité de la vessie, de la membrane ou du piston, il est possible que de l'azote soit dissout dans le fluide sous pression. A la décharge, lorsque la pression est plus basse, le gaz s'échappe brusquement du fluide et se dilate à cette occasion. Cet état de fait doit être pris en compte lors de la détermination des réservoirs, des filtres etc...

* seulement pour des accumulateurs à vessie

Aufstellung, Ausrüstung und Betrieb von Hydrospeichern in der Bundesrepublik Deutschland

Die Installation, Ausrüstung und der Betrieb von Hydrospeichern in der Bundesrepublik Deutschland werden durch die "Technischen Regeln Druckbehälter" (TRB) geregelt. Aus diesen geht hervor, daß folgende Sicherheits-einrichtungen und Ausstattungen vorhanden sein müssen:

1. Sicherheitsventil gegen Drucküberschreitung
2. Manometer
3. Absperrventil
4. Entlastungsventil
5. Anschluß für Prüfmanometer

Diese sind platzsparend in einem HYDAC-Sicherheits- und Absperrblock zusammengefaßt. Zusätzlich sind lieferbar:

6. Elektromagnetisch betätigtes Entlastungsventil
7. Drossel
8. Sicherheitsventil gegen Temperaturüberschreitung

DE - SCHWABT

En Allemagne, l'installation et la mise en service des accumulateurs hydro-pneumatiques sont soumises aux règles du TRB (Technische Regeln für Druckbehälter). Les dispositifs de sécurité et les équipements suivants sont obligatoires:

1. Limiteur de pression
2. Manomètre
3. Dispositif d'isolement
4. Dispositif de décharge manuelle
5. Prise de pression pour raccordement d'un manomètre de contrôle

Les blocs de sécurité HYDAC regroupent tous ces éléments dans une solution compacte et sûre.

6. Electrovanne de décharge
7. Orifice
8. Safety valve to prevent excess temperatures

GASFÜLLDRUCKES

1. PRÜFINTERVALLE

Nach Inbetriebnahme des Speichers soll der Gasfülldruck in der ersten Woche mindestens 1 mal geprüft werden. Wird kein Stickstoffverlust festgestellt, sollte eine weitere Prüfung nach ca. 4 Monaten erfolgen. Sollte auch dann keine Druckänderung eingetreten sein, ist eine jährliche Überprüfung des Gasfülldruckes ausreichend.

2. MESSEN DES GASFÜLLDRUCKES MIT MANOMETER AUF DER FLÜSSIGKEITSEITE

Voraussetzung: Manometer ist an einer - mit dem Speicher in direkter Verbindung stehenden - Hydraulikleitung ange-schlossen (gegebenenfalls Manometer am Entlastungs-anschluß anbringen).

Vorgehensweise:

- Druckflüssigkeit in den Speicher füllen.
- Absperrventil schließen.
- Durch Öffnen des Entlastungsventils Druckflüssigkeit sehr langsam abfließen lassen (Temperaturausgleich).
- Handrad oder Hebel des Entlastungsventils nach links drehen, wobei der Hebel durch Anziehen um-gesetzt werden kann.
- Während des Entlastungs-vorganges Manometer ständig beobachten: Manometer fällt schlagartig auf Null! Zuletzt angezeigter Druck entspricht dem Gasfülldruck.
- Stimmt der Gasfülldruck nicht, so muß der Speicher nachgefüllt werden (siehe III.3.).

III. CONTRÔLE DE LA PRESSION DE GONFLAGE

1. EXAMEN PÉRIODIQUE

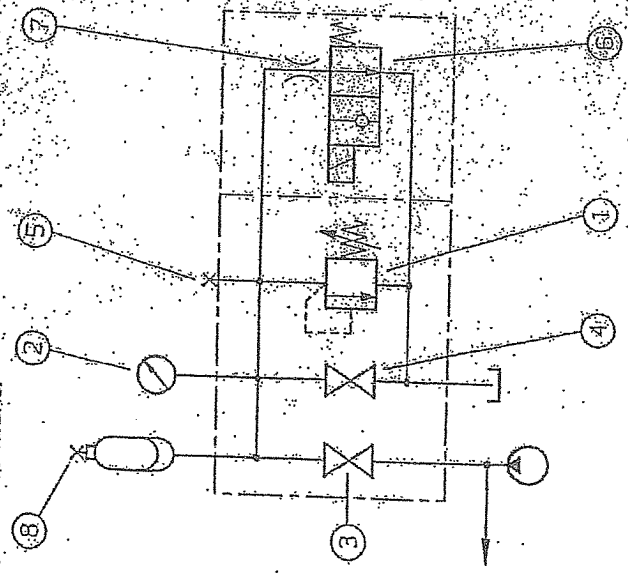
Une vérification de la pression de gonflage est à effectuer pendant la première semaine après la mise en service de l'accumulateur. Si aucune perte d'azote n'est détectée, un autre contrôle est à prévoir après 4 mois. Si à la suite de ce deuxième contrôle la pression d'azote est restée inchangée, un contrôle annuel sera alors suffisant.

2. MESURE DE LA PRESSION AVEC UN MANOMÈTRE COTÉ FLUIDE

Condition: Le manomètre est monté sur une partie du circuit directement reliée avec l'accumulateur (le cas échéant le manomètre doit être monté au niveau de la vis de purge). Marche à suivre:

- Mettre l'accumulateur sous pression.
- Fermer la vanne d'isolement.
- Décharger lentement l'accumulateur en ouvrant la vanne (compensation de la température). Tourner la molette ou le levier vers la gauche. La position initiale du levier peut-être modifiée en le tirant vers vous.
- Durant le vidange, observer continuellement le manomètre. Le manomètre tombe brusquement à 0! La dernière pression indiquée correspond à la pression de gaz.
- Si cette pression est insuffisante, il faut la corriger (voir III.3.).

Schaltplan eines HYDAC-Sicherheits- und Absperrblockes:
Circuit diagram of a HYDAC safety and shut-off block.
Schéma d'un bloc de sécurité HYDAC.



3. MEASUREMENT OF GAS RE-CHARGING PRESSURE USING HYDAC CHARGING AND TESTING UNIT (FPU)

See operating instructions for charging and testing unit. Service agencies on request. Further information: Operating instructions for hydraulic accumulators, Instructions for assembly and repair.

3. MESURE DE LA PRESSION DE GONFLAGE AVEC HYDAC, DISPOSITIF DE GONFLAGE ET DE CONTRÔLE

Consultez le Mode d'emploi du dispositif de gonflage et de contrôle. Liste des Points Services sur demande. Informations complémentaires: voir Notice de montage et réparation pour accumulateurs hydro-pneumatiques.

0. Inhaltsverzeichnis

1. Gültigkeit
2. Funktionsbeschreibung
3. Sicherheitshinweise
4. Inbetriebnahme
5. Wartung und Instandhaltung

1. Gültigkeit

Vorliegende technische Dokumentation gilt für folgende hydraulische Robotergewichtsausgleiche:

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 1	0599.00.000/1	01-033-573
GA 1 – A	0617.00.000/1	01-034-571
GA 2 – D.1	0699.00.000/6	00-124-428
GA 2 – D.2	0699.00.000/7	71-040-031
GA 2 – K.1	0969.00.000/1	71-040-031
GA 2 – K.2	0969.00.000/2	71-040-031
GA 5	0734.00.000/1	00-100-278
GA 5.2	0734.00.000/3	00-118-267
GA 5.3	0734.00.000/4	00-118-267
GA 5-A	1103.00.000	00-167-918
GA 6	0752.00.000	00-100-797
GA 6.2	0752.00.000/2	00-118-268
GA 6.3	0752.00.000/3	00-118-268
GA 7	0862.00.000	00-120-082
GA 8	0879.00.000	01-040-047
GA 9	0966.00.000	00-139-944
GA 11	0999.00.000	00-147-094
GA 14	1144.00.000	00-183-637
GA 14-FO	1154.00.000	00-188-591
GA 15	1145.00.000	00-183-853
GA 16	1160.00.000	00-189-401
GA 17	1161.00.000	00-190-013

Die technische Dokumentation richtet sich an **ausgebildetes, qualifiziertes Fachpersonal**, das mit der Bedienung des Roboters, in dem der Gewichtsausgleich eingebaut wird, vertraut ist und die Sicherheitsbestimmungen in diesem Zusammenhang kennt.

2. Funktionsbeschreibung
2.1 Bestimmungsgemäße Verwendung

Es handelt sich bei diesen Baugruppen um ein geschlossenes hydraulisches System, das als Gewichtsausgleich für Industrieroboter (Achse 2) konzipiert und ausgelegt wurde. Folgende Typen wirken ziehend, d.h. der Stangenraum des Zylinders steht unter Druckvorspannung. Diese Typen sind für Industrieroboter mit Bodenbefestigung bestimmt.

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 1	0599.00.000/1	01-033-573
GA 1 – A	0617.00.000/1	01-034-571
GA 2 – D.1	0699.00.000/6	00-124-428
GA 2 – D.2	0699.00.000/7	71-040-031
GA 2 – K.1	0969.00.000/1	71-040-031
GA 2 – K.2	0969.00.000/2	71-040-031
GA 5	0734.00.000/1	00-100-278
GA 5.2	0734.00.000/3	00-118-267
GA 5.3	0734.00.000/4	00-118-267
GA 5-A	1103.00.000	00-167-918
GA 11	0999.00.000	00-147-094
GA 14	1144.00.000	00-183-637
GA 14-FO	1154.00.000	00-188-591
GA 16	1160.00.000	00-189-401

Diese Typen werden mit Öl- und Gasfüllung von der Fa. ÖLHYDRAULIK ALTENERDING ausgeliefert.

Folgende Typen wirken drückend, d.h. der Kolbenraum des Zylinders steht unter Druckvorspannung. Diese Typen sind für Industrieroboter mit Decken- oder Wandbefestigung bestimmt.

Type:	ÖA Zeichnungsnr.:	KUKA Sachnr.:
GA 6	0752.00.000	00-100-797
GA 6.2	0752.00.000/2	00-118-268
GA 6.3	0752.00.000/3	00-118-268
GA 7	0862.00.000	00-120-082
GA 8	0879.00.000	01-040-047
GA 9	0966.00.000	00-139-944
GA 15	1145.00.000	00-183-853
GA 17	1161.00.000	00-190-013

Diese Typen werden nur mit Gasfüllung von der Fa. ÖLHYDRAULIK ALTENERDING ausgeliefert. Die Ölbefüllung wird vom Roboterhersteller durchgeführt.

Die Gewichtsausgleiche sind nur für die hier aufgeführten Verwendungen bestimmt. Andere Verwendungen sind nicht zulässig und gelten als sachwidrige Verwendung !

2.2 Technische Daten und Anschlussschema des Gewichtsausgleichs

Technische Daten siehe Konformitätserklärung MO-017.
Anschlussschema siehe Beschreibung der Baugruppe MO-018 unter Punkt 2 Anschlussschema.

Es sind ausschließlich die in der Beschreibung der Baugruppe MO-018 unter Punkt 3 aufgeführten Bestandteile zu verwenden.

3. Sicherheitshinweise

3.1 Sorgfaltspflicht des Betreibers

Der Gewichtsausgleich wurde unter Berücksichtigung einer Gefahrenanalyse konstruiert und hergestellt.

Die erforderlichen Maßnahmen zur Sicherheit in der betrieblichen Praxis unterliegen der Sorgfaltspflicht des Betreibers. Der Betreiber muß insbesondere sicherstellen, dass

- der Gewichtsausgleich bestimmungsgemäß verwendet wird (siehe Punkt 2.1 der techn. Dokumentation).
- der Gewichtsausgleich nur in einwandfreiem Zustand eingebaut und betrieben wird.
- sich während des Betriebs keine Personen im Abblasebereich des Speichersicherheitsventils aufhalten.
- der Gewichtsausgleich nur von qualifiziertem Fachpersonal eingebaut und gewartet wird, und diesem die erforderliche Schutzausrüstung zur Verfügung steht und diese benutzt.
- keine Sicherheits- und Warnhinweise auf dem Gewichtsausgleich entfernt werden.
- die techn. Dokumentation zu Gewichtsausgleich, Druckspeicher und Speichersicherheitsventil vollständig und leserlich zur Verfügung steht.

3.2 Umgang mit Hydrauliköl

- Die Sicherheitshinweise für den Umgang mit Hydrauliköl sind zu beachten. Siehe auch die techn. Dokumentation für Speichersicherheitsventil unter Punkt 3.
ACHTUNG ! Der Gewichtsausgleich steht unter hohem Innendruck. Es dürfen keine Bauteile gelöst werden, solange das System unter Druck steht.

3.3 Stickstoffbefüllung des Druckspeichers

- Zum Befüllen nur Stickstoff N2 der Reinheit 99,8 % verwenden !
IN KEINEM FALLE SAUERSTOFF ODER LUFT VERWENDEN ! EXPLOSIONSGEFAHR !!
Sofern der Gasflaschendruck höher als der max. zul. Druck ist, muss ein Gasdruckbegrenzungsventil verwendet werden.
- Die Sicherheitshinweise der Betriebsvorschrift für Einbau und Wartung des Druckspeichers sind zu beachten !

3.4 Thermische Gefährdung

- Bei Arbeiten am Gewichtsausgleich besteht die Gefahr von Verbrennungen durch Kontakt mit heißem Hydrauliköl oder erwärmtem Gerät.

3.5 Veränderungen am Gewichtsausgleich

- Am Gewichtsausgleich dürfen keine eigenmächtigen Veränderungen durchgeführt werden. Alle geplanten Veränderungen müssen von der Fa. ÖLHYDRAULIK ALTENERDING schriftlich genehmigt werden.
Das alternativ zum Luftfilter eingebaute Rückschlagventil für die Kolben- bzw Stangenraumentlüftung darf nicht verschlossen werden !

4. Inbetriebnahme

- Die Inbetriebnahme darf nur von qualifiziertem Fachpersonal durchgeführt werden.
- Nach dem Einbau des Gewichtsausgleichs ist das Hubdistanzstück zwischen Führung und Stangenauge (unter dem Faltenbalg) zu entfernen !! **
GEFAHR der Beschädigung durch Kollision !
- ** Ausnahme bei Type GA 14 und GA14-FO
Bei diesen Typen ist anstelle des Hubdistanzstückes ein Montagebolzen am Zylinderboden zur Hubbegrenzung eingeschraubt. Nach dem Einbau des Gewichtsausgleichs ist der Montagebolzen herauszuschrauben und durch die mitgelieferte Verschlussschraube zu ersetzen.
GEFAHR der Beschädigung durch Kollision, wenn der Montagebolzen nicht entfernt wird !
- Kontrolle des Öldruckes am Manometer. Auf ungewöhnliche Druckschwankungen und abweichenden Einstelldruck achten. Siehe Beschreibung der Baugruppe Punkt 4.

5. Wartung und Instandhaltung

Bei allen Wartungs- und Reparaturarbeiten ist auf äußerste Sauberkeit zu achten !

5.1 Kontrolle des allgemeinen Zustandes

- Gewichtsausgleich wöchentlich optisch auf Beschädigung, Verschmutzung und Dichtheit kontrollieren.

5.2 Überprüfung und Korrektur des Öldruckes

- Überprüfung des Öldruckes erfolgt am Manometer bei mechanischer Nullstellung der Achse 2 .
- Zur Druckerhöhung gefiltertes Hydrauliköl vom Typ ARAL Vitam GF 46 verwenden.
- Folgende Anforderungen an das HLP Öl sind einzuhalten
kinematische Ölviskosität 40°C 46 cSt
Ölreinheit nach ISO DIS 4406 18/1571
bzw. NAS Klasse 7
Die Ölbefüllung erfolgt über das Rückschlagventil am Ölbefüllanschluss A. *
- Hierzu ist ein Hydraulikschlauch mit Verschraubung 8 S (Überwurfmutter M 16x1,5) sowie ein Pumpenaggregat mit Druckfilter erforderlich. Gleichzeitig ist über den Minimessanschluss M16x2 am Entlüftungsanschluss E zu entlüften.
- Zur Druckreduzierung Öldruck über den Minimessanschluss M16x2 ablassen.
- * Ausnahme bei Type GA 1 und GA 1 - A :
Die Ölbefüllung erfolgt über den Anschluss A. Hierzu ist die Verschlusschraube VSTI-R1/4" zu lösen und langsam herauszuschrauben !
ACHTUNG ! Gefahr durch herausspritzendes Öl bei Leckage des Absperrhahnes !
Anschließen des Befüllschlauches durch Einschrauben einer Hydraulikverschraubung GE 8 PSR (PB 630 bar). Den gewünschten Einstelldruck am Pumpenaggregat einstellen und über einen Druckfilter Öldruck auf den Anschluss A geben.
Jetzt die Flachkopfschraube am Absperrhahn entfernen und den Absperrhahn langsam herauszuschrauben und den Druck am Manometer des Gewichtsausgleichs kontrollieren.
Gleichzeitig an dem obenliegenden Minimessanschluss M16x2 entlüften.
- Anschließend Absperrhahn wieder hineinschrauben und anziehen. Verschraubung GE 8 PSR entfernen und VSTI Verschlusschraube G1/4" wieder einschrauben und mit Anzugsmoment 30 Nm anziehen.
- Zur Druckreduzierung Öldruck über den Minimessanschluss M16x2 ablassen.

5.3 Überprüfung und Korrektur des Gasdruckes

ACHTUNG !
Druckspeicher steht unter Gasvorspannung !!
Sicherheitshinweise Punkt 3 beachten !

- Überprüfung des Gasfülldruckes gemäß Betriebsvorschrift für Einbau und Wartung von Hydrospeichern durchführen.

5.4 Demontage und Wiedermontage

- Die Demontage und Wiedermontage des Gewichtsausgleichs darf ausschließlich von autorisierten Fachbetrieben mit entsprechenden Montage- und Demontageanweisungen durchgeführt werden.
- Bei unzulässigem Eingriff in den Gewichtsausgleich erlischt die Gewährleistung !

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KUKA

KUKA Roboter GmbH

Zugspitzstrasse 140
D-86165 Augsburg / Germany
Tel. +49 (0)821-797-0

Company / customer
Project description
Job number
Commission

KRC4-SC4 X11 X51 X66 PB PFC TRAFO
0011019824

Manufacturer (company) KUKA Roboter GmbH

Project name
make
Type
Place of installation
Responsible for project
Supply voltage

KRC4
3x480V

Created on 23.05.2013
Edit date 23.05.2013

from ARr
Number of pages 46

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+DOKU

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2	table of contents Inhaltsverzeichnis	23.05.2013	Rottnair	Rottnair
2a	table of contents Inhaltsverzeichnis	23.05.2013	Rottnair	Rottnair
2b	table of contents Inhaltsverzeichnis	23.05.2013	Rottnair	Rottnair

+E

Single-pole overview Einpolige Übersicht

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2	Overview of CCU signals Übersicht CCU-Signale	23.05.2013	Rottnair	Rottnair
3	Overview of CCU signals Übersicht CCU-Signale	23.05.2013	Rottnair	Rottnair
4	Bus overview Busübersicht	23.05.2013	Rottnair	Rottnair
5	Overview of axes Übersicht Achsen	23.05.2013	Rottnair	Rottnair
6	Overview of interface Übersicht Schnittstelle	23.05.2013	Rottnair	Rottnair

+G

Circuit diagram Stromlaufplan

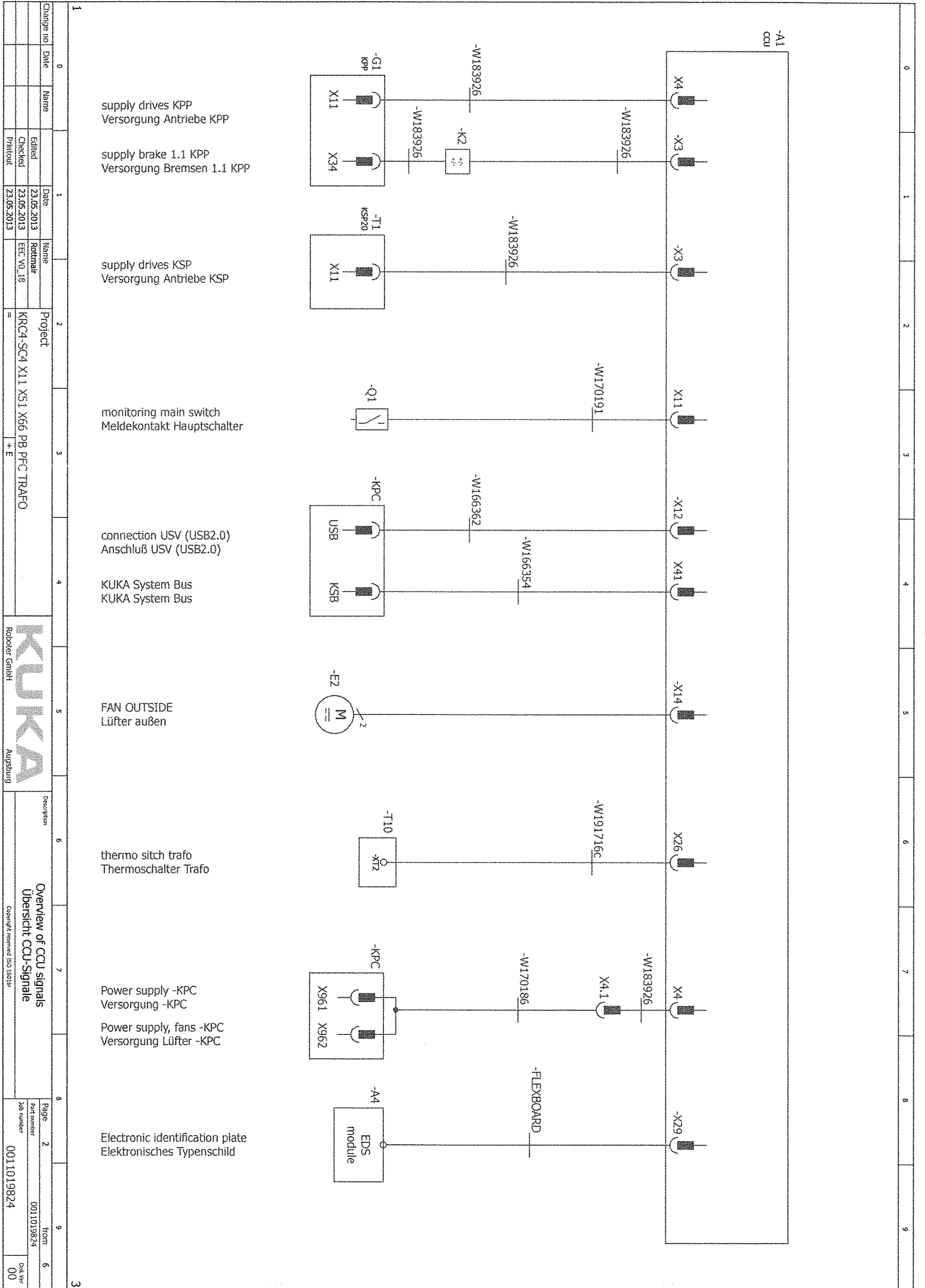
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8	Ballast resistor Ballastwiderstand	23.05.2013	Rottnair	Rottnair
9	CCU connections Anschlüsse CCU	23.05.2013	Rottnair	Rottnair

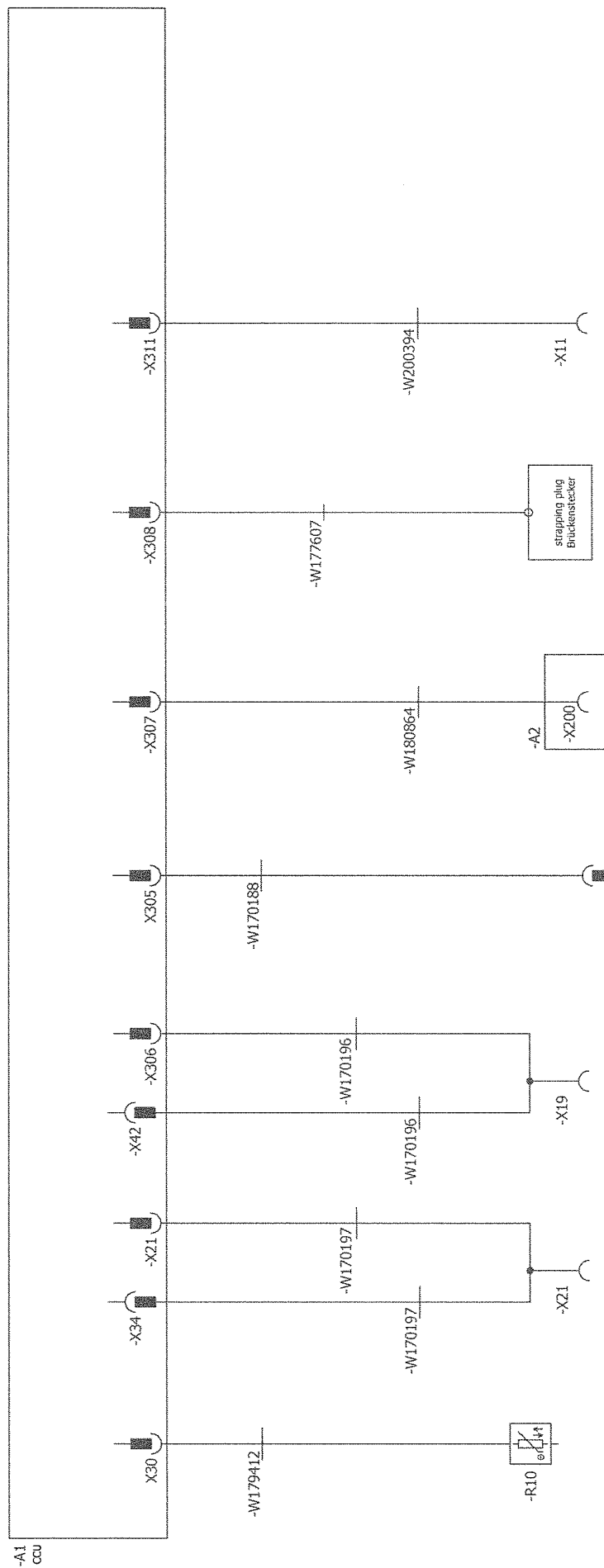
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			23.05.2013	ECC VO 18	KRC+SC4 X11 X51 X66 PB PFC TRAFO					Job number	0011019824
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KUKA
Rohrer GmbH
Augsburg

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		12	CCU connections Anschlüsse CCU			23.05.2013			Rottmair
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		14	CCU connections Anschlüsse CCU			23.05.2013			Rottmair
		15	CCU connections Anschlüsse CCU			23.05.2013			Rottmair
		16	KCB bus connection KCB-BUS Verbindung			23.05.2013			Rottmair
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		2	MidSize housing rear Gehäuse MidSize hinten			23.05.2013			Rottmair
		3	Housing top view / floor Gehäuse Draufsicht / Boden			23.05.2013			Rottmair
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		7	Beckhoff_modules Beckhoff_Module			23.05.2013			Rottmair
		8	Connector arrangement -A1 (CCU) Steckeranordnung -A1 (CCU)			23.05.2013			Rottmair
		9	Overview of SIB STD Übersicht SIB STD			23.05.2013			Rottmair





TEMPERATURE CONTROL
BALLAST
Temperaturkontrolle
Ballastwiderstände

Robot controller bus
Controllerbus Roboter

KUKA Control Panel interface
Kuka Control Panel Interface

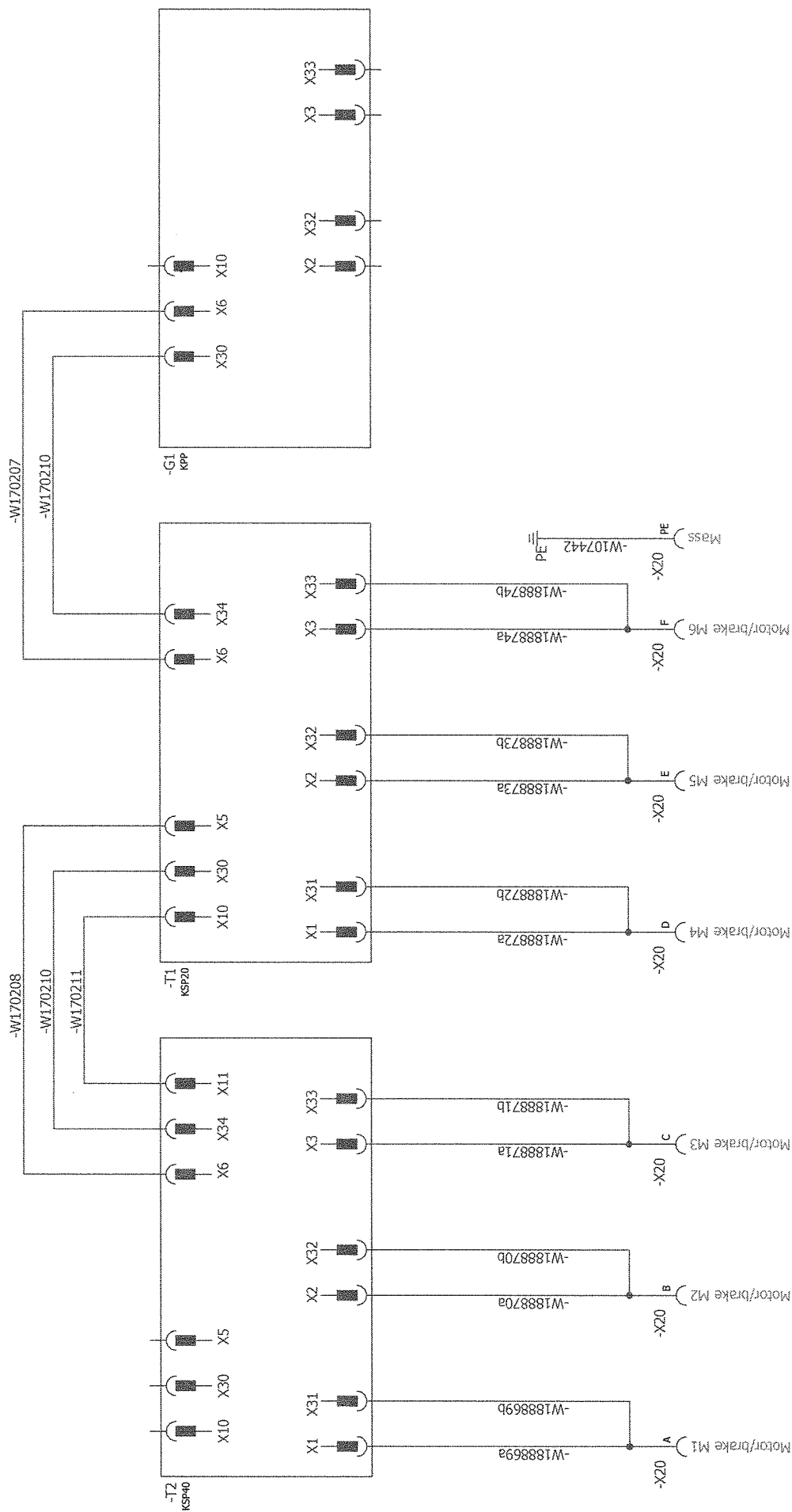
SUPPLY AKKU
Versorgung AKKU

CSP
CSP

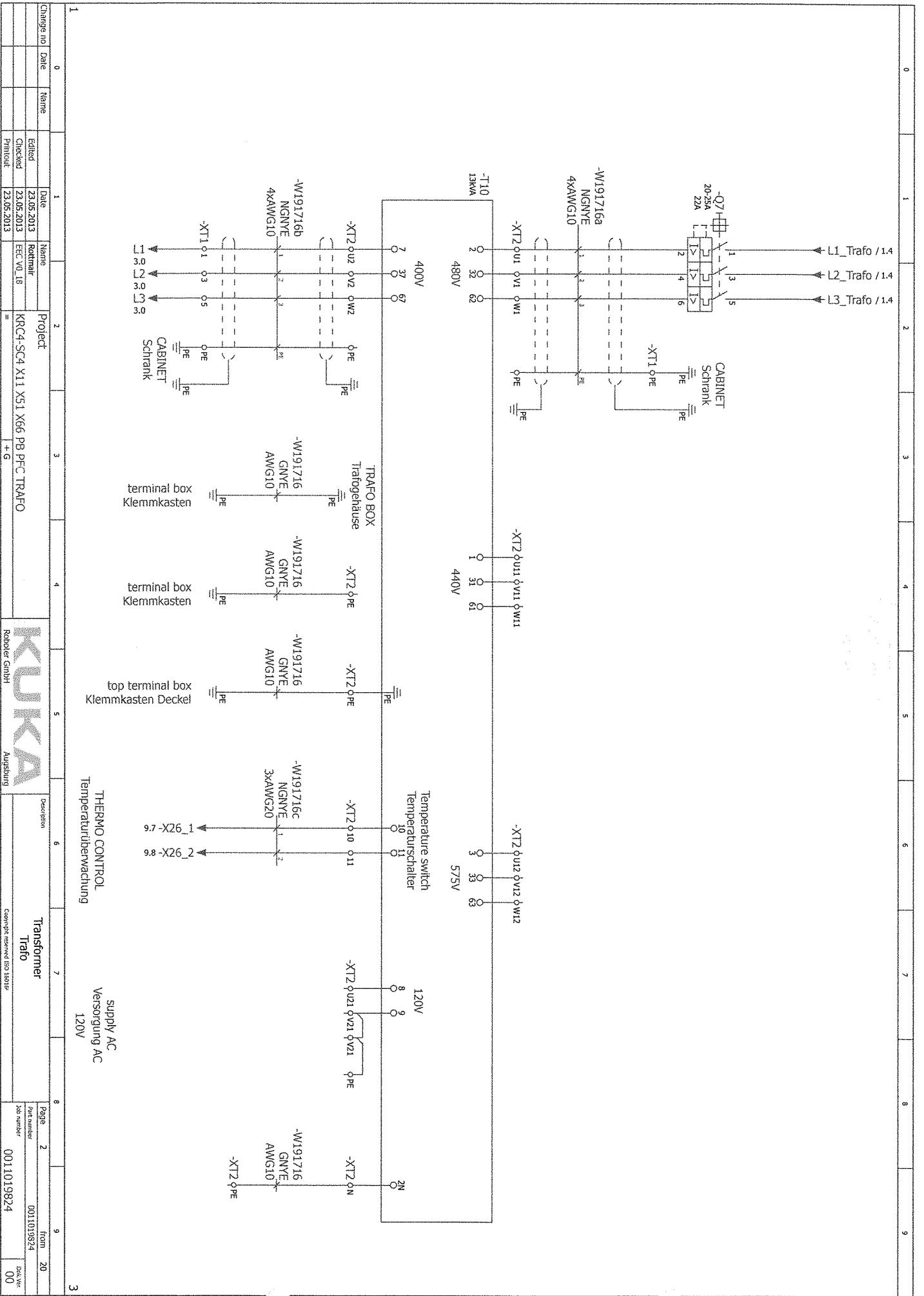
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Fremdeinspeisung von Extern

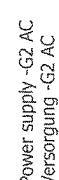
External enabling
Zustimmung Extern

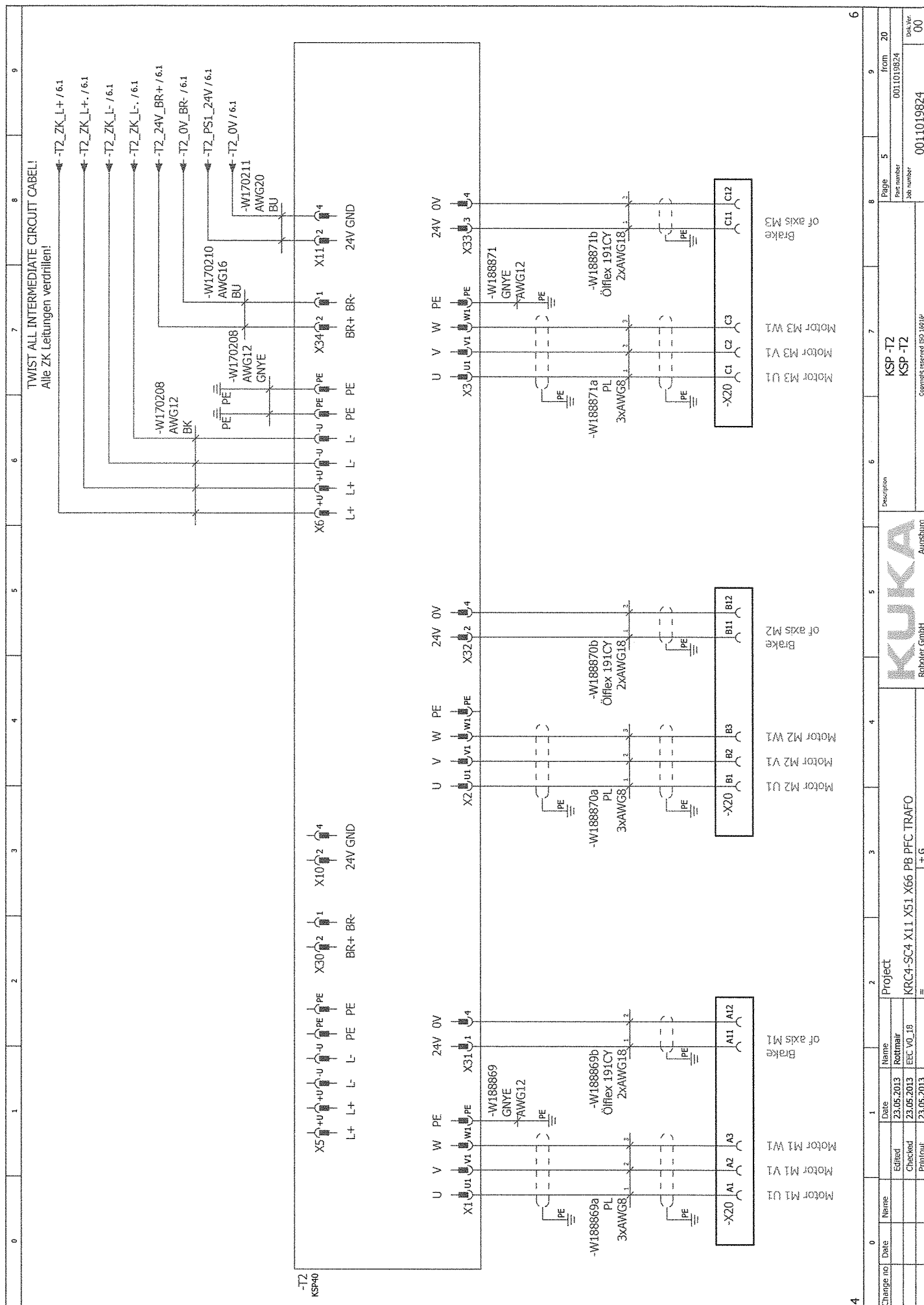
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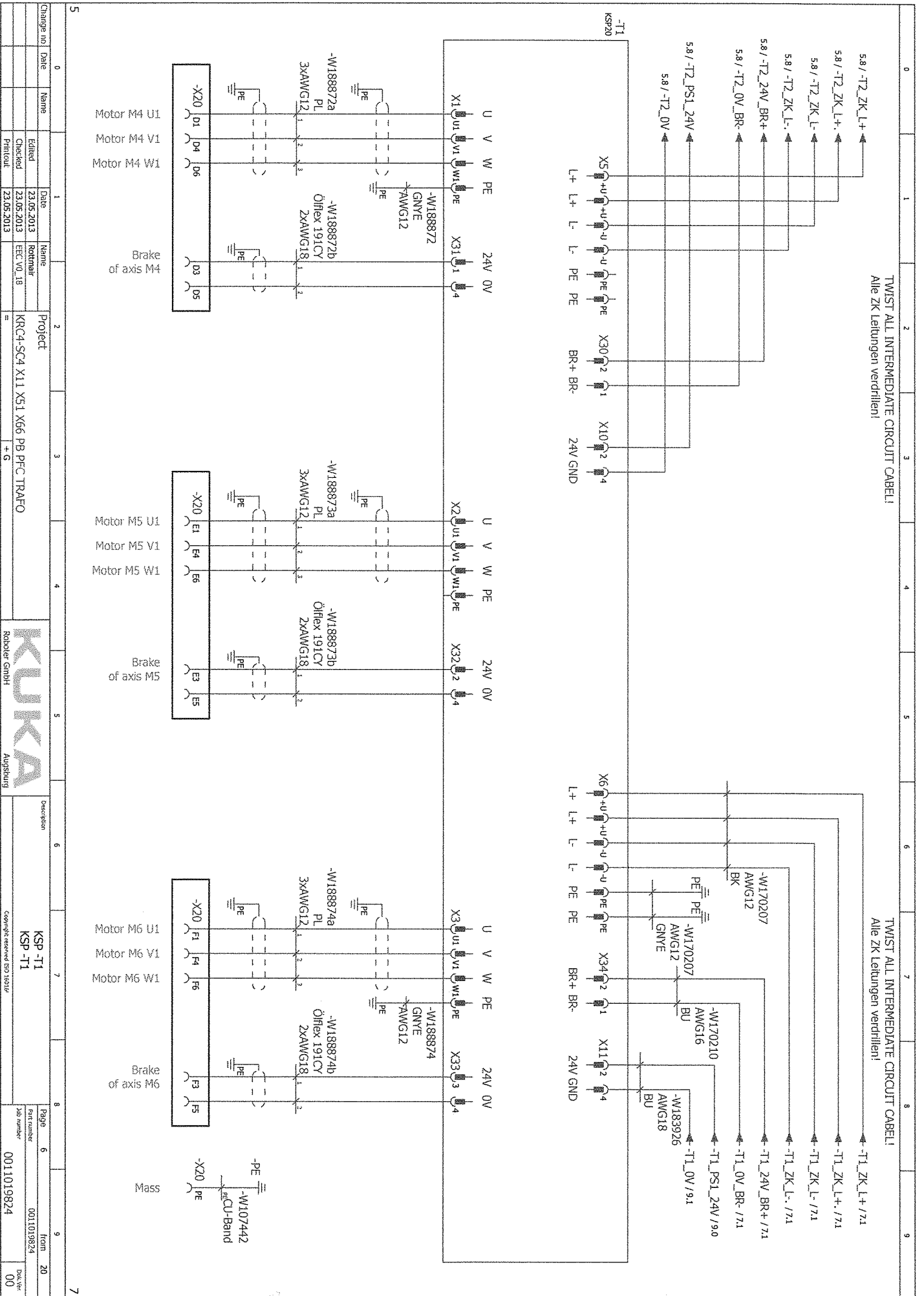


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Interface -X11 Schnittstelle -X11									
-A3 -X253 -X252 -W187757 -W187758 -X11									
Page 6 Part number 0011019824 Job number 0011019824 DAK No 00									

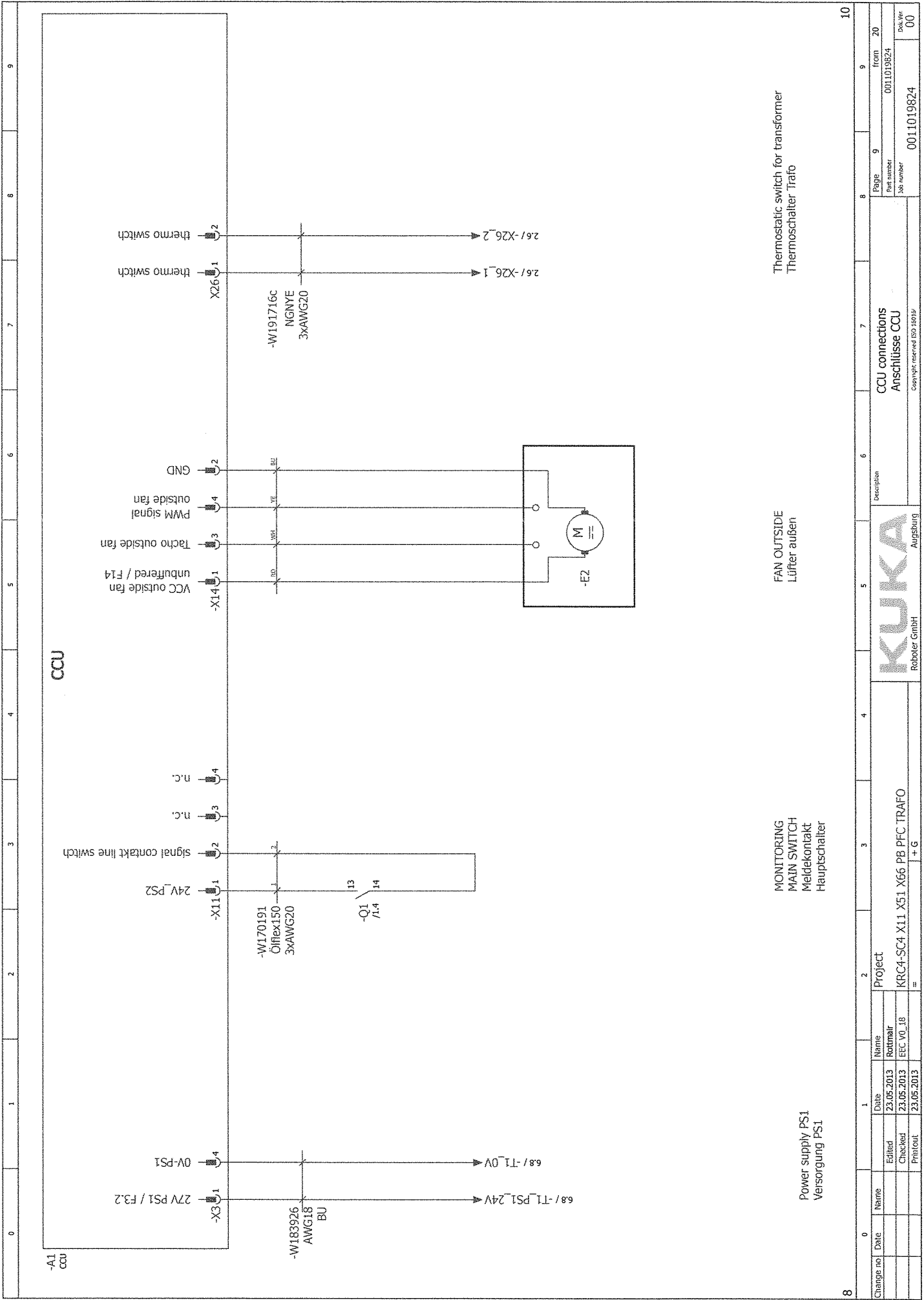








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Power supply PS1
Versorgung PS1

FAN OUTSIDE
Lüfter außen

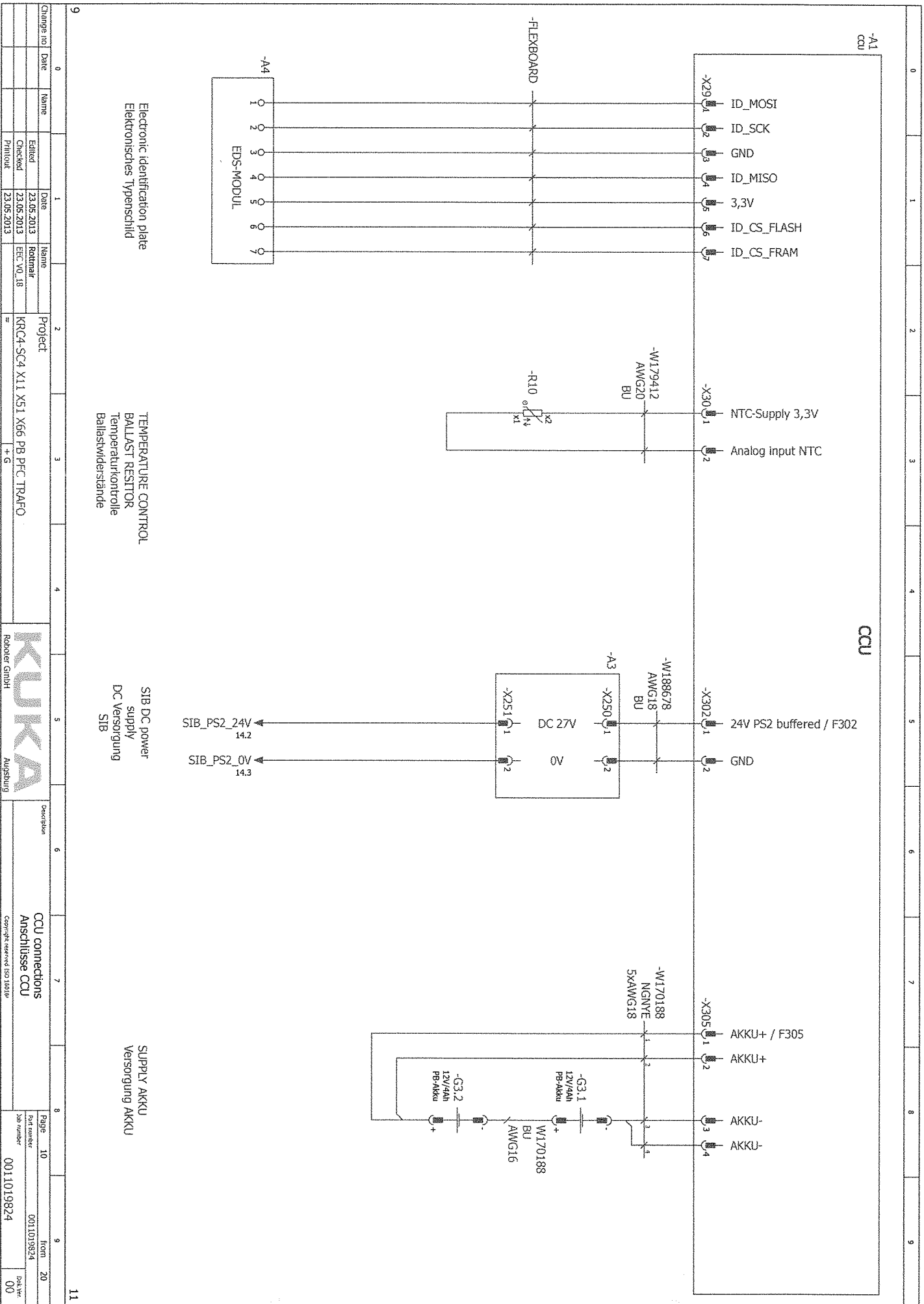
MONITORING
MAIN SWITCH
Meldekontakt
Hauptschalter

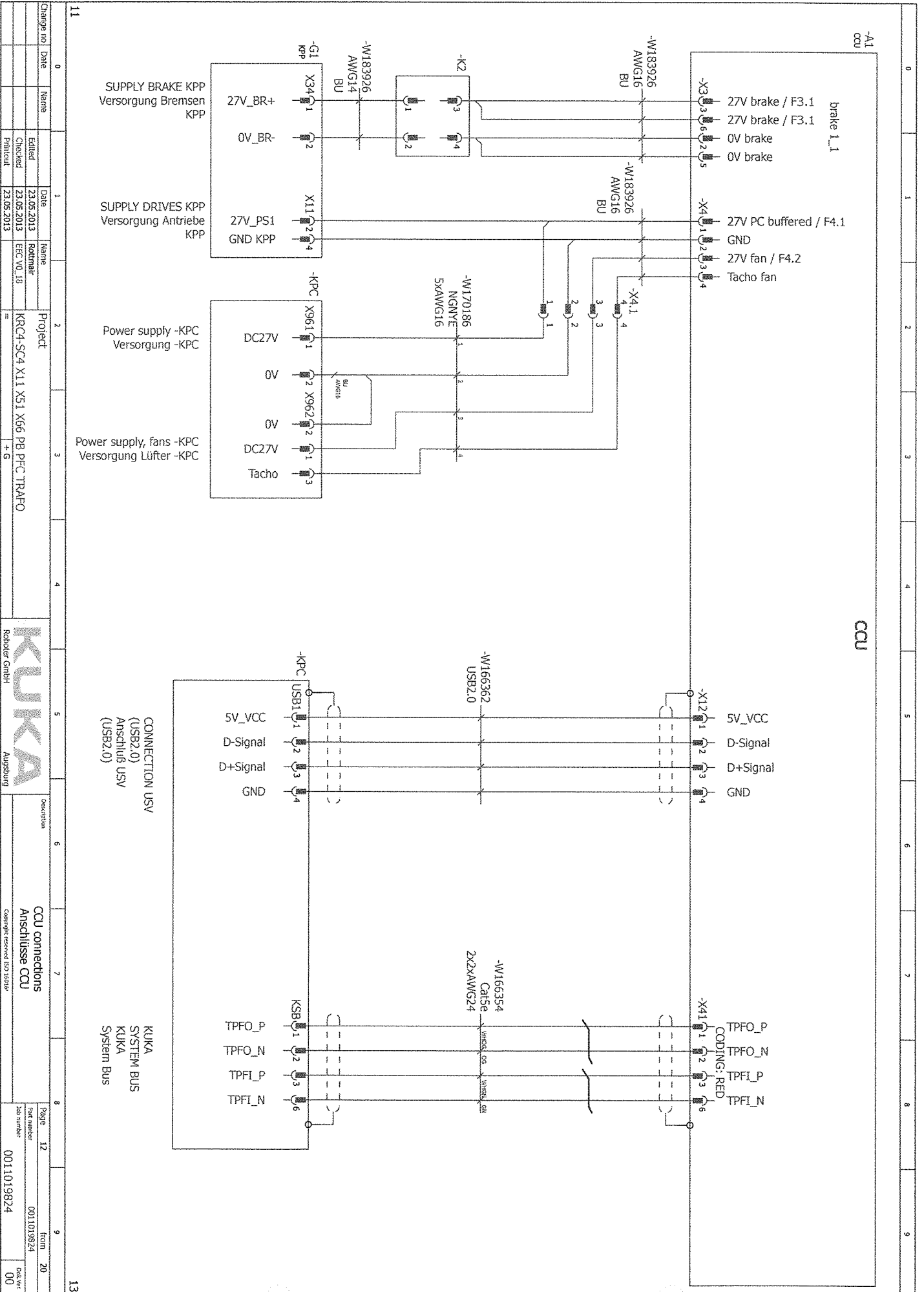
Thermostatic switch for transformer
Thermoschalter Trafo

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8			23.05.2013	EEC VO_18	+	Copyright reserved ISO 15019	9	9	20	00

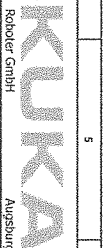


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Augsburg

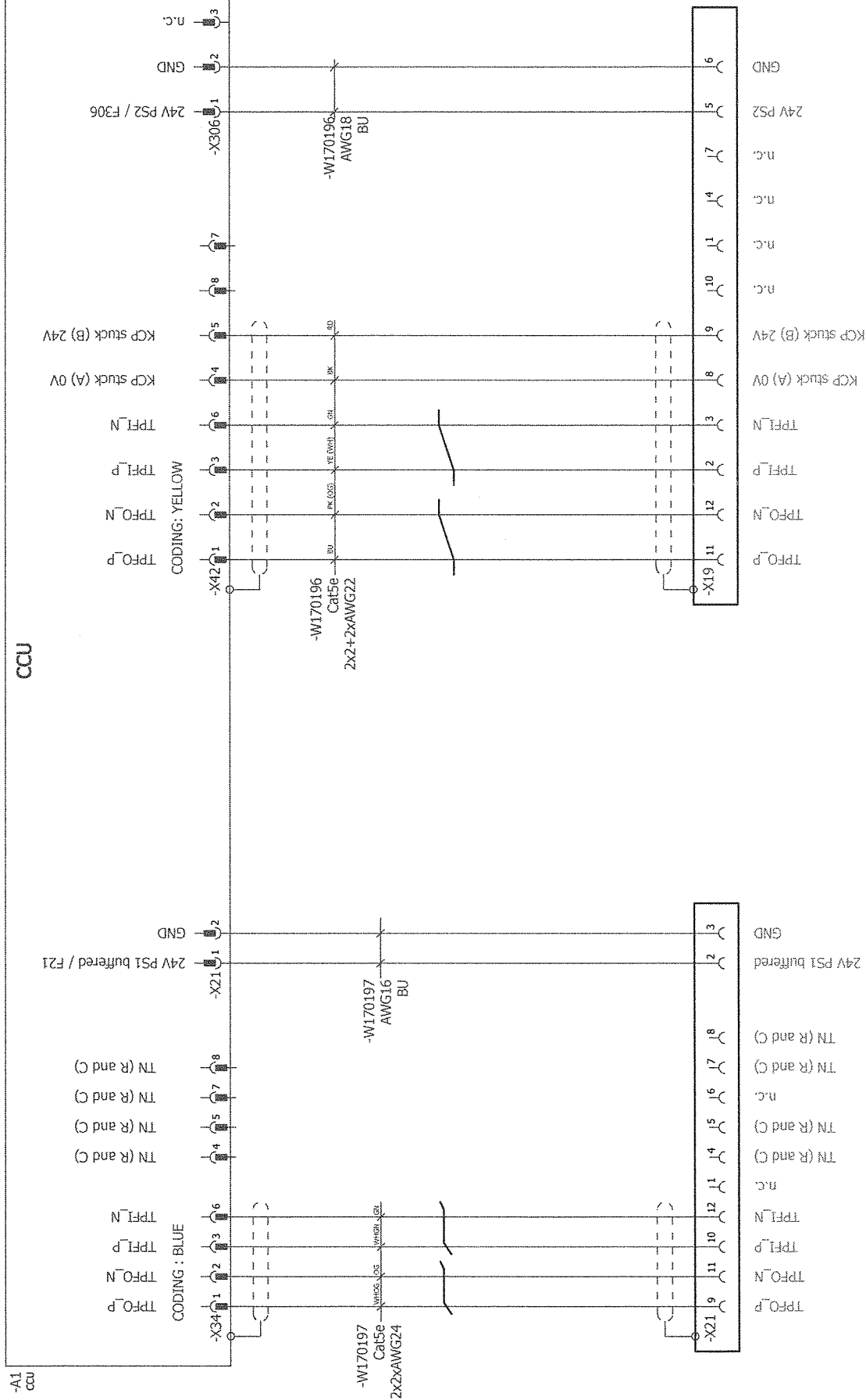




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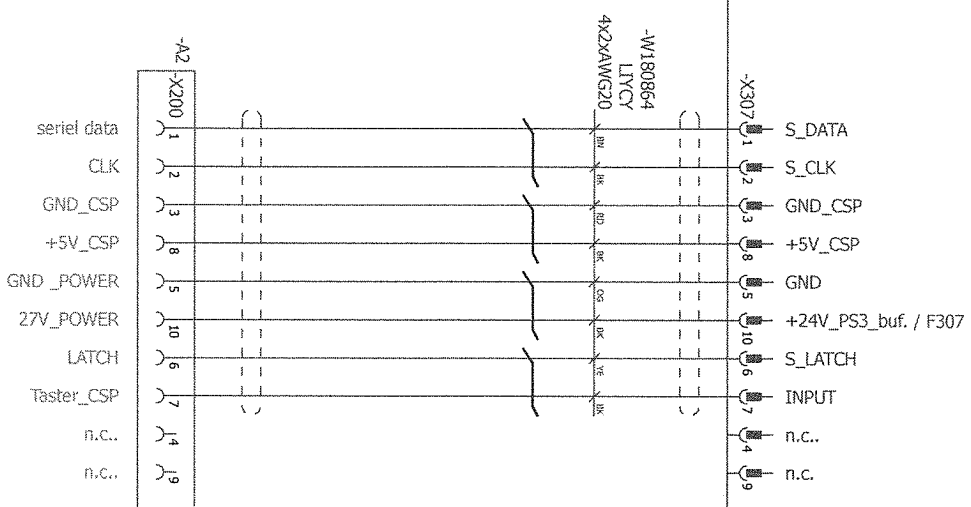
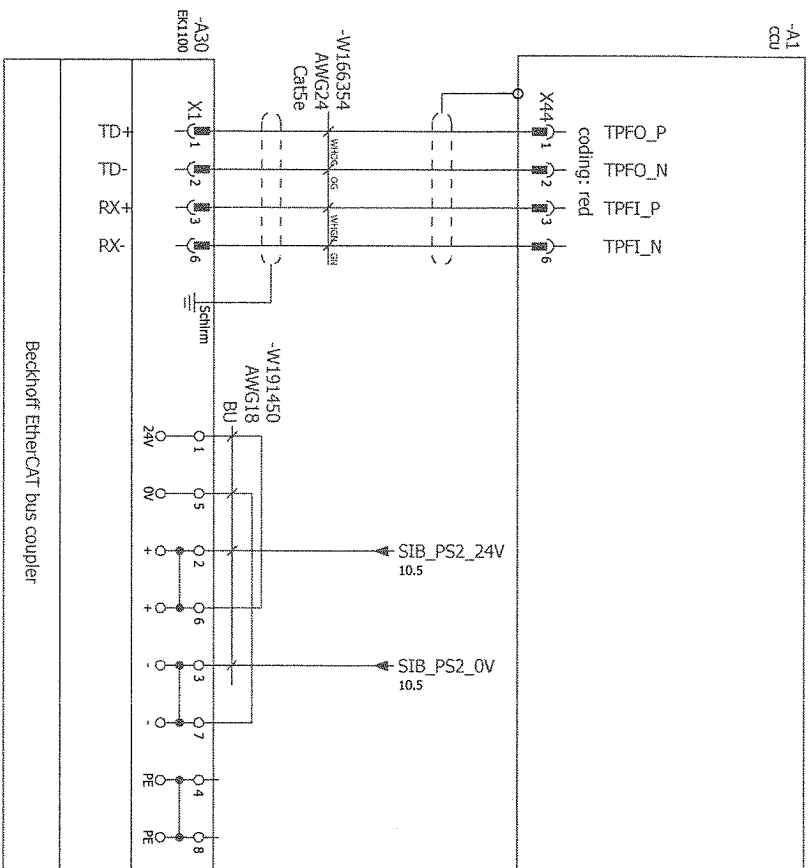
CCU connections
Anschlüsse CCU

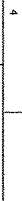


CONTROLLER BUS ROBOT
Controllerbus Roboter

KUKA CONTROL PANEL INTERFACE
Kuka Control Panel Interface

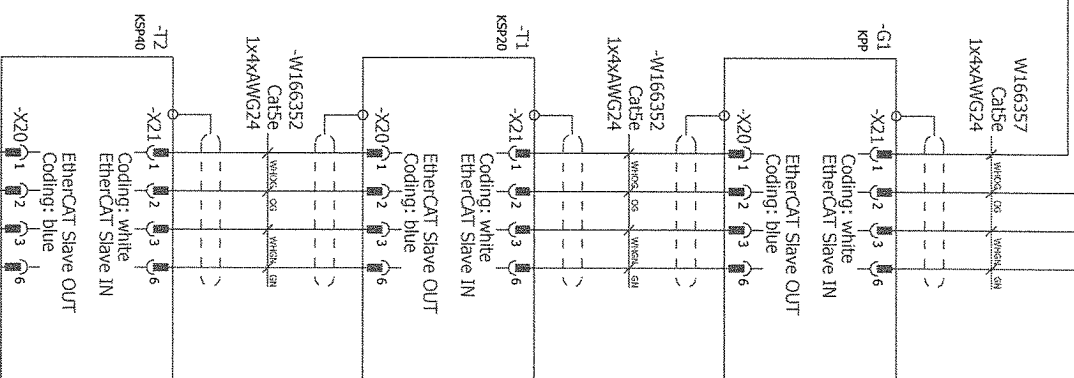
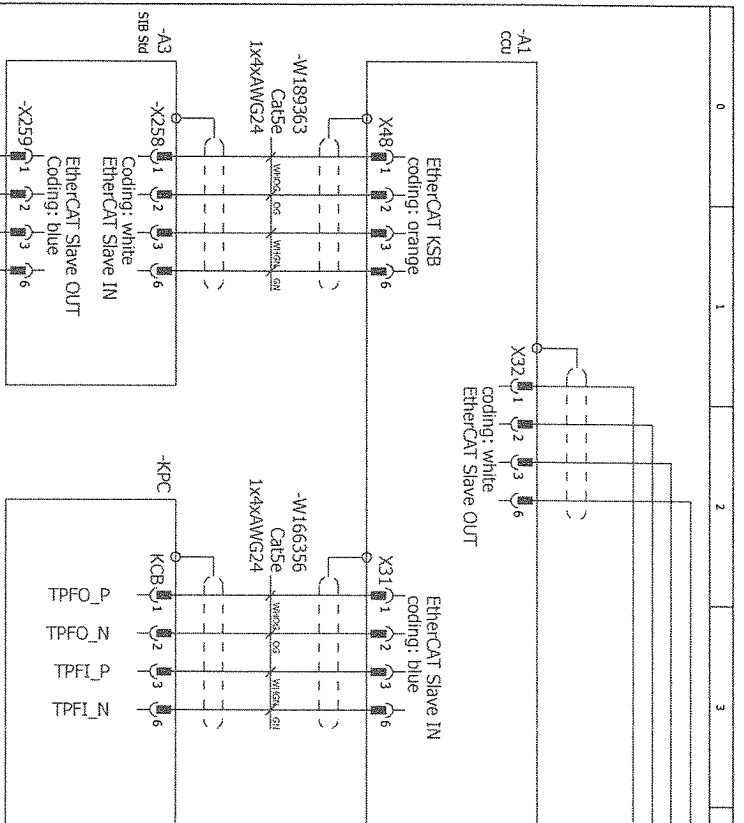
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Checked		23.05.2013	EEC VO_18	Checked		23.05.2013	EEC VO_18	KRC4-SC4 X11 X51 X66 PB PFC TRAFO		Anschlüsse CCU		Part number		
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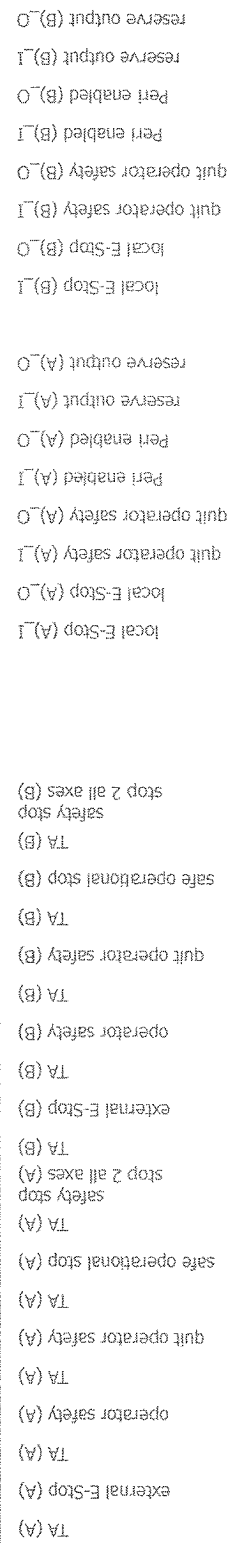


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Robbier GmbH Augsburg																				



KUKA
Roboter GmbH
Augsburg



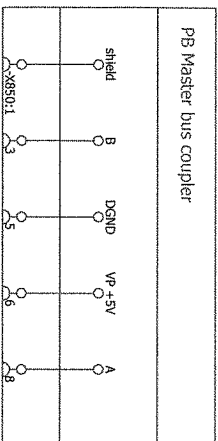


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EL6731

FL6731

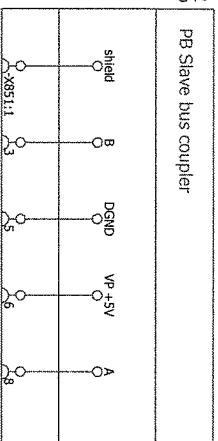
PB Master bus coupler



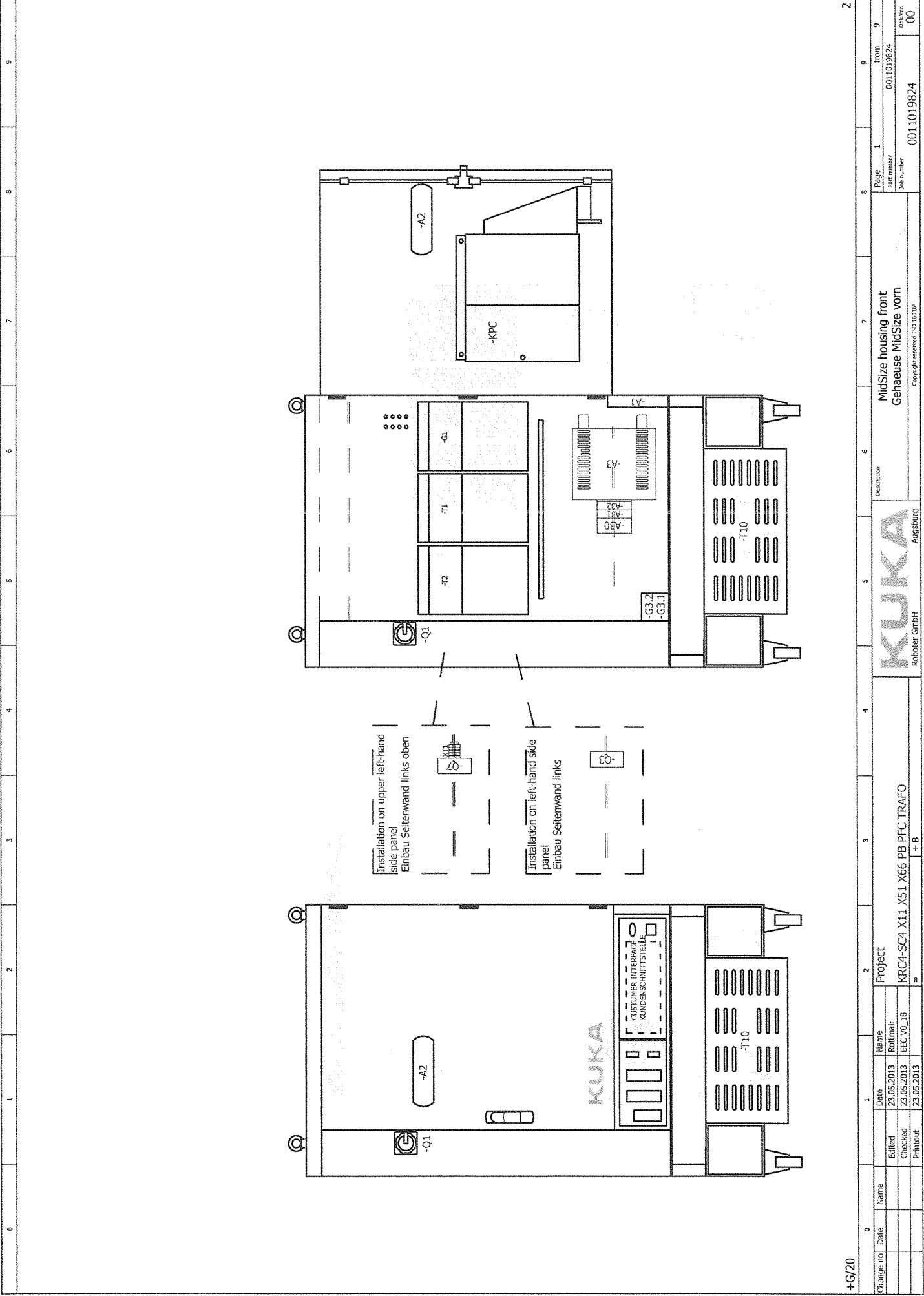
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EL6731-0010

7CV-
EL6731-0010

PB Slave bus coupler



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					Beckhoff module connections Anschlüsse Beckhoff Module														
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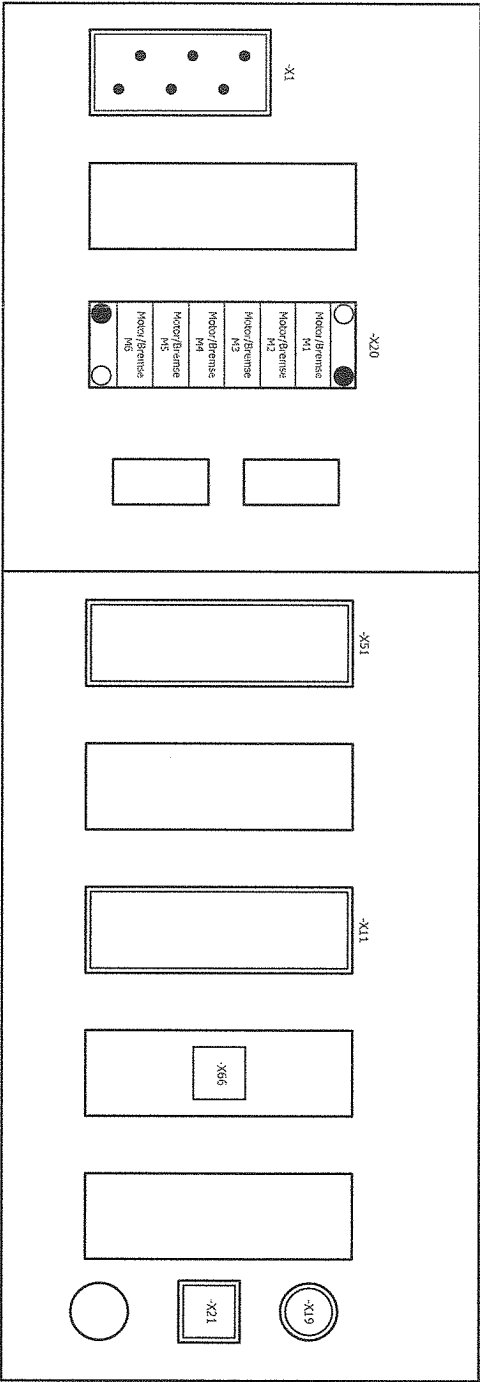
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+ B										
Description										
MdSize housing rear										
Gehäuse MdSize hinten										
Part number										
Job number										
0011019824										
Dsk Ver										
00										

The drawing shows the rear view of a KUKA robot housing. It includes a terminal box labeled 'TERMINAL BOX' with 'Klemmkasten' below it. There are two circular fans at the bottom, one labeled 'E2'. The drawing is oriented vertically on the page.

This drawing is identical to the one above, showing the rear view of the KUKA robot housing with the terminal box and fans.

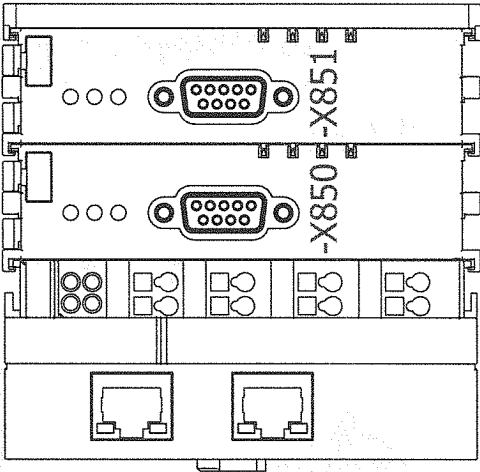
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VIEW OUTSIDE Ansicht von Aussen



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Printout				23.05.2013	+ B							
					KUKA			Robotur GmbH		Augsburg		
					Description			Connector panel		Steckerfeld		
								Page		from		
								Job number		0011019824		
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Buskoppler EtherCat
EK1100

Buskoppler PB Master
EL6731

Buskoppler PB Slave
EL6731-0010

EL9011

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		Edited	23.05.2013	EEC VO_16	
		Checked	23.05.2013		
		Printout			

Beckhoff modules
Beckhoff_Module

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Part number 0011019824

Job number 0011019824

Desk No 00

8

Plug diagram

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Strip designation		Target designation		Target designation		Cable name		Cable type		Page / column
function text	Connection point	Plug designation	jumper	device connection point	Connection point					
TA (A)	1	-A3-X253	4	BK	/19.0	-W187758	SRV D 321C			
external E-Stop (A)	2	-A3-X253	12	WH	/19.0	-W200394	SRV D 321C			
TA (A)	3	-A3-X253	5	RD	/19.1					
operator safety (A)	4	-A3-X253	11	GN	/19.1					
TA (A)	5	-A3-X253	14	OG	/19.1					
quit operator safety (A)	6	-A3-X253	2	BU	/19.1					
TA (A)	7	-A3-X253	15	WH/BK	/19.1					
safe operational stop (A)	8	-A3-X253	19	RD/BK	/19.2					
TA (A)	9	-A3-X253	16	GN/BK	/19.2					
safety stop stop 2 all axes (A)	10	-A3-X253	9	OG/BK	/19.2					
TA (A)	11	-A1-X311	8	BK	/15.0					
consent extern 1 (A)	12	-A1-X311	12	WH	/15.0					
TA (A)	13	-A1-X311	9	RD	/15.1					
consent extern 2 (A)	14	-A1-X311	11	GN	/15.1					
TA (B)	19	-A3-X253	6	BU/BK	/19.2					
external E-Stop (B)	20	-A3-X253	13	BK/WH	/19.2					
TA (B)	21	-A3-X253	7	RD/WH	/19.3					
operator safety (B)	22	-A3-X253	1	GN/WH	/19.3					
TA (B)	23	-A3-X253	8	BU/WH	/19.3					
quit operator safety (B)	24	-A3-X253	3	BK/RD	/19.3					
TA (B)	25	-A3-X253	17	WH/RD	/19.3					
safe operational stop (B)	26	-A3-X253	20	OG/RD	/19.4					
TA (B)	27	-A3-X253	18	BU/RD	/19.4					
safety stop stop 2 all axes (B)	28	-A3-X253	10	RD/GN	/19.4					
TA (B)	29	-A1-X311	4	OG	/15.1					
consent extern 1 (B)	30	-A1-X311	1	BU	/15.1					
TA (B)	31	-A1-X311	5	WH/BK	/15.1					
consent extern 2 (B)	32	-A1-X311	2	RD/BK	/15.2					
local E-Stop (A)_O	37	-A3-X252	1	BK	/19.5					
quit operator safety (A)_I	38	-A3-X252	3	WH	/19.5					
quit operator safety (A)_O	39	-A3-X252	2	RD	/19.5					
Peri enabled (A)_I	40	-A3-X252	4	GN	/19.5					
Peri enabled (A)_O	41	-A3-X252	10	OG	/19.6					
reserve output (A)_I	42	-A3-X252	12	BU	/19.6					
	43	-A3-X252	11	BU/WH	/19.6					

Plug diagram

function text		Target designation		Strip designation =+G-X19		Target designation		Cable name		Cat5e		Page / column	
Connection point		Plug designation		jumper		device connection point		Connection point		cable type			
n.c.		1						-A1-X42	3			/13.7	
TPFL P		2						-A1-X42	6			/13.6	
TPFL N		3						-A1-X42	1			/13.6	
n.c.		4						-A1-X306	2			/13.7	
24V P52		5						-A1-X306	4			/13.8	
GNP		6						-A1-X42	5			/13.8	
n.c.		7						-A1-X42	1			/13.5	
KCP stuck (A) 0V		8						-A1-X42	2			/13.5	
KCP stuck (B) 24V		9											
n.c.		10											
TPFO P		11											
TPFO N		12											

Plug diagram

function text		Strip designation =+G-X21		Target designation		Plug designation		Connection point		jumper		device connection point		Target designation		Connection point		cable type		Cable name		Cat5e		Page / column	
n.c.						1								-A1-X21		1		/13.1		-W170197				/13.1	
24V PS1 buffered						2								-A1-X21		2		/13.2						/13.2	
GND						3								-A1-X21		3		/13.3						/13.3	
TN (R and C)						4										4		/13.1						/13.1	
TN (R and C)						5										5		/13.1						/13.1	
n.c.						6										6		/13.2						/13.2	
TN (R and C)						7										7		/13.2						/13.2	
TN (R and C)						8										8		/13.0						/13.0	
TPFO_P						9								-A1-X34		9		/13.1						/13.1	
TPFL_P						10								-A1-X34		10		/13.0						/13.0	
TPFO_N						11								-A1-X34		11		/13.1						/13.1	
TPFL_N						12								-A1-X34		12		/13.1						/13.1	



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Augsburg

Strip designation
==+G-X66

0	1	2	3	4	5	6	7	8	9
Change no	Date	Name	Project			Description		Page	6
	23.05.2013	Reinhardt	KRC4-SC4 X11 X51 X66 PB PFC TRAFO			KUKA	Steckerplan = +G-X66	Part number	0011019824
	23.05.2013	ECF VO_18				Roboter GmbH	Steckerplan = +G-X66	Job number	0011019824
	23.05.2013	Printout	=			Augsburg	Copyright reserved 500 Jahre	Dat. Nr.	00
			+ K1M						

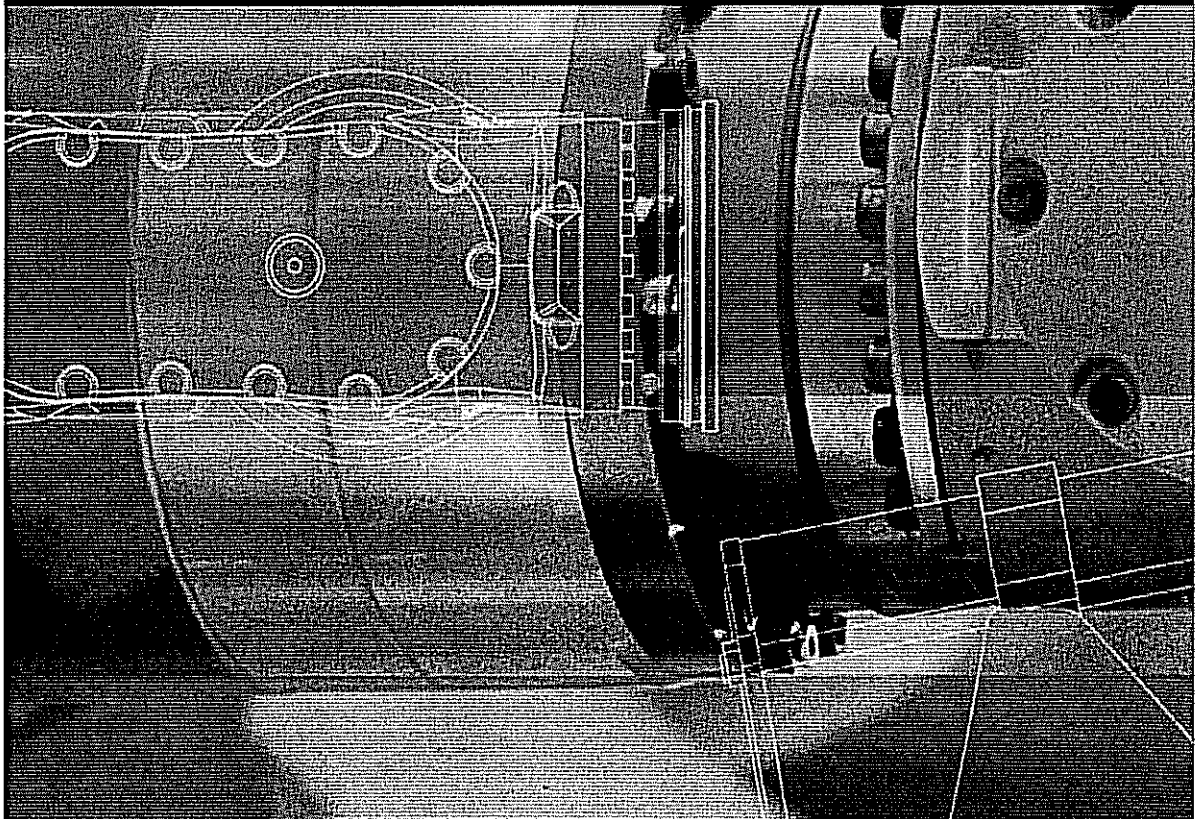
KUKA

Robots

KUKA Roboter GmbH

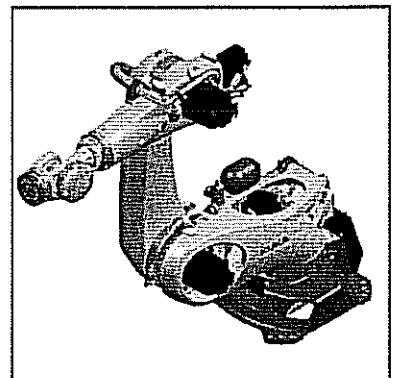
KR QUANTEC K prime

Operating Instructions



Issued: 20.08.2012

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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

Translation of the original documentation

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1 Introduction

1.1 Industrial robot documentation

The industrial robot documentation consists of the following parts:

- Documentation for the manipulator
- Documentation for the robot controller
- Operating and programming instructions for the KUKA System Software
- Documentation relating to options and accessories
- Parts catalog on storage medium

Each of these sets of instructions is a separate document.

1.2 Representation of warnings and notes

Safety

These warnings are relevant to safety and **must** be observed.



These warnings mean that it is certain or highly probable that death or severe physical injury **will** occur, if no precautions are taken.



These warnings mean that death or severe physical injury **may** occur, if no precautions are taken.



These warnings mean that minor physical injuries **may** occur, if no precautions are taken.



These warnings mean that damage to property **may** occur, if no precautions are taken.



These warnings contain references to safety-relevant information or general safety measures. These warnings do not refer to individual hazards or individual precautionary measures.

Notes

These hints serve to make your work easier or contain references to further information.



Tip to make your work easier or reference to further information.

2 Purpose

2.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of mechanical engineering
- Advanced knowledge of electrical and electronic systems
- Knowledge of the robot controller system



For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

2.2 Intended use

Use

The industrial robot is intended for handling tools and fixtures, or for processing or transferring components or products. Use is only permitted under the specified environmental conditions.

Misuse

Any use or application deviating from the intended use is deemed to be impermissible misuse; examples of such misuse include:

- Transportation of persons and animals
- Use as a climbing aid
- Operation outside the permissible operating parameters
- Use in potentially explosive environments



Changing the structure of the manipulator, e.g. by drilling holes, etc., can result in damage to the components. This is considered improper use and leads to loss of guarantee and liability entitlements.



The robot system is an integral part of a complete system and may only be operated in a CE-compliant system.

3 Product description

3.1 Overview of the robot system

A robot system comprises all the assemblies of an industrial robot, including the manipulator (mechanical system and electrical installations), control cabinet, connecting cables, end effector (tool) and other equipment. The KR QUANTEC K prime product family comprises the types:

- KR 210 R2900 K prime
- KR 180 R3100 K prime
- KR 150 R3300 K prime
- KR 120 R3500 K prime
- KR 90 R3700 K prime

An industrial robot of this type comprises the following components:

- Manipulator
- Robot controller
- Connecting cables
- KCP teach pendant (KUKA smartPAD)
- Software
- Options, accessories

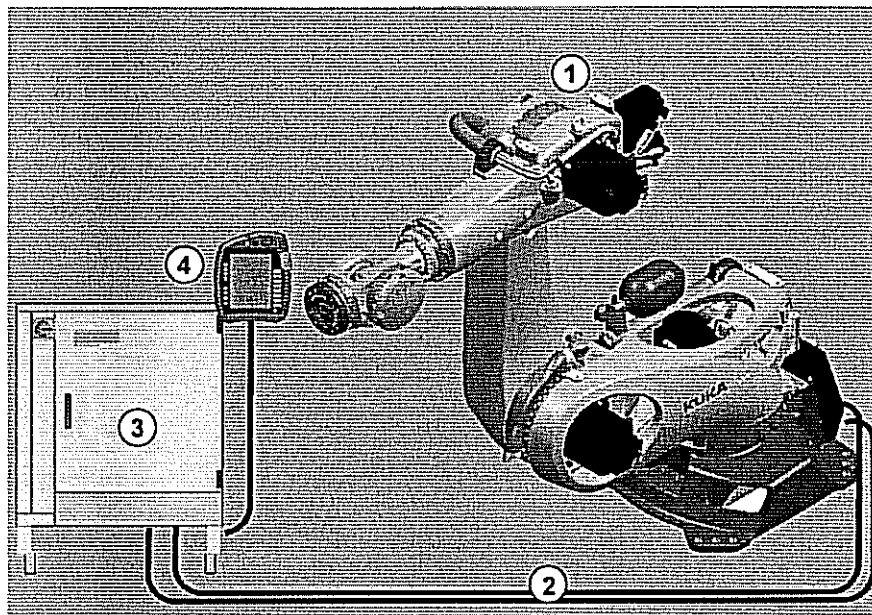


Fig. 3-1: Example of a robot system

- | | |
|---------------------|--------------------------------------|
| 1 Manipulator | 3 Robot controller |
| 2 Connecting cables | 4 Teach pendant KCP
KUKA smartPAD |

3.2 Description of the manipulator

Overview

The manipulators (robot = robot arm and electrical installations) of the "prime" shelf-mounted robot variants are designed as 6-axis jointed-arm kinematic systems. They consist of the following principal components:

- In-line wrist
- Arm

- Link arm
- Rotating column
- Base frame
- Counterbalancing system
- Electrical installations

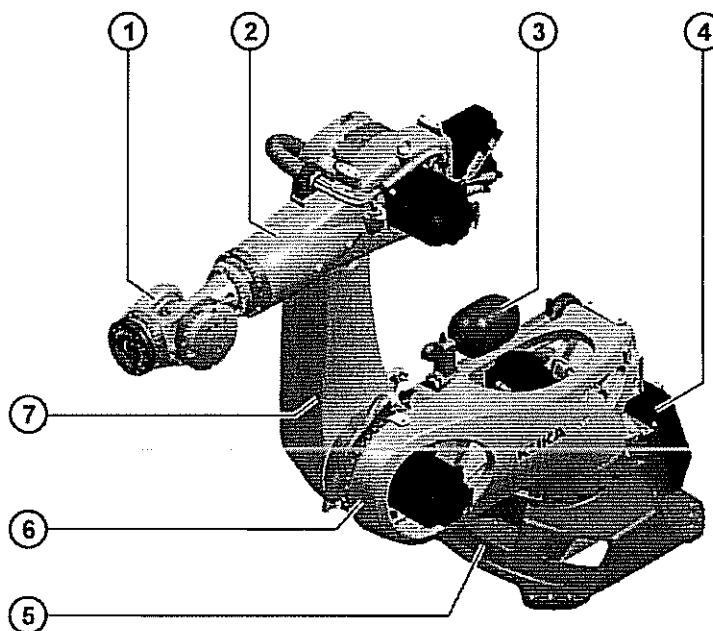


Fig. 3-2: Main assemblies of the manipulator

- | | |
|----------------------------|-------------------|
| 1 In-line wrist | 5 Base frame |
| 2 Arm | 6 Rotating column |
| 3 Counterbalancing system | 7 Link arm |
| 4 Electrical installations | |

In-line wrist

The robot is fitted with a 3-axis in-line wrist. The in-line wrist contains axes 4, 5 and 6. The motor of axis 6 is located directly on the wrist, inside the arm. It drives the wrist directly, while for axes 4 and 5 the drive comes from the rear of the arm via connecting shafts. For attaching end effectors (tools), the in-line wrist has a mounting flange. For the payload categories from 210 kg to 270 kg, a mounting flange with a 160 mm hole circle is used, and for the payload categories from 90 kg to 180 kg, a mounting flange with a 125 mm hole circle is used. Both mounting flanges conform, with minimal deviations, to DIN/ISO 9409.

Arm

The arm is the link between the in-line wrist and the link arm. It houses the motors of the wrist axes A4 and A5. The arm is driven by the motor of axis 3. The maximum permissible swivel angle is mechanically limited by a stop for each direction, plus and minus. The associated buffers are attached to the arm. There is an interface on the arm with 4 holes for fastening supplementary loads. In combination with the link arm, there are three variants available to obtain the specified reach.

Link arm

The link arm is the assembly located between the arm and the rotating column. It consists of the link arm body with the buffers for axis 2. In combination with the arm, there are two variants available to obtain the specified reach.

Rotating column

The rotating column houses the motors of axes 1 and 2. The rotational motion of axis 1 is performed by the rotating column. This is screwed to the base

frame via the gear unit of axis 1 and is driven by a motor in the rotating column. The link arm is also mounted in the rotating column.

Base frame	The base frame is the base of the robot. It is screwed to the mounting base. The push-in module and the electrical installations are fastened in the base frame. It thus forms the interface for the motor and data cable and the energy supply system.
Counterbalancing system	The counterbalancing system is installed between the rotating column and the link arm and serves to minimize the moments generated about axis 2 when the robot is in motion and at rest. A closed, hydropneumatic system is used. The system consists of an accumulator, a hydraulic cylinder with associated hoses, a pressure gauge and a bursting disc as a safety element to protect against overload. The accumulators correspond to category II, fluid group 2, of the Pressure Equipment Directive. This classification entails that the counterbalancing system be subjected to an inspection before start-up and again at regular intervals in compliance with the requirements of the relevant authorities.
Electrical installations	The electrical installations include all the motor and data cables for the motors of axes 1 to 6. All connections are implemented as connectors in order to enable the motors to be exchanged quickly and reliably. The electrical installations also include the RDC box and the multi-function housing (MFH). The RDC box is located in the rotating column. The MFH and the connector for the data cables are mounted on the robot base frame. The connecting cables from the robot controller are connected here by means of connectors. The electrical installations also include a protective circuit.
Options	The robot can be fitted and operated with various options, such as energy supply systems for axes 1 to 3, energy supply systems for axes 3 to 6, or working range limitation systems for A1. The options are described in separate documentation.

4 Technical data

4.1 Basic data

Basic data

Type	KR 210 R2900 K prime KR 180 R3100 K prime KR 150 R3300 K prime KR 120 R3500 K prime KR 90 R3700 K prime
Number of axes	6
Volume of working envelope	KR 210 R2900 K prime 77.90 m ³ KR 180 R3100 K prime 97.80 m ³ KR 150 R3300 K prime 120.62 m ³ KR 120 R3500 K prime 146.73 m ³ KR 90 R3700 K prime 175.26 m ³
Pose repeatability (ISO 9283)	±0.06 mm
Working envelope reference point	Intersection of axes 4 and 5
Weight	KR 210 R2900 K prime approx. 1,180 kg KR 180 R3100 K prime approx. 1,168 kg KR 150 R3300 K prime approx. 1,184 kg KR 120 R3500 K prime approx. 1,192 kg KR 90 R3700 K prime approx. 1,204 kg
Principal dynamic loads	See "Loads acting on the mounting base"
Protection classification of the robot	IP 65 ready for operation, with connecting cables plugged in (according to EN 60529)
Protection classification of the in-line wrist	IP 65
Sound level	< 75 dB (A) outside the working envelope
Mounting position	Floor Permissible angle of inclination 0°
Surface finish, paint-work	Base frame: black (RAL 9005); moving parts: KUKA orange 2567

Ambient temperature

Operation	283 K to 328 K (+10 °C to +55 °C)
Storage and transportation	233 K to 333 K (-40 °C to +60 °C)
Start-up	283 K to 288 K (+10 °C to +15 °C) At these temperatures the robot may have to be warmed up before normal operation. Other temperature limits available on request.
Ambient conditions	DIN EN 60721-3-3, Class 3K3

The maintenance intervals and the specified service life are based on typical gear unit temperatures and axis motions. If special functions or applications result in atypical gear unit temperatures or axis motions, this can lead to increased wear. In this case, the maintenance intervals or service life may be shortened. If you have any questions, please contact KUKA Customer Support.

Connecting cables

Cable designation	Connector designation robot controller - robot	Interface with robot
Motor cable	X20 - X30	Harting connectors at both ends
Data cable	X21 - X31	HAN 3A EMC at both ends
Ground conductor / equipotential bonding 16 mm ² (can be ordered as an option)		M8 ring cable lug at both ends
Cable lengths		
Standard	7 m, 15 m, 25 m, 35 m, 50 m	
Minimum bending radius	5x D	

For detailed specifications of the connecting cables, see "Description of the connecting cables".

4.2 Axis data

Axis data, KR 210 R2900 K prime

Axis	Range of motion, software-limited	Speed with rated payload
1	+/-185°	105°/s
2	-120° to +70°	107°/s
3	-120° to +155°	114°/s
4	+/-350°	136°/s
5	+/-122.5°	129°/s
6	+/-350°	206°/s

Axis data, KR 180 R3100 K prime

Axis	Range of motion, software-limited	Speed with rated payload
1	+/-185°	105°/s
2	-120° to +70°	107°/s
3	-120° to +155°	114°/s
4	+/-350°	179°/s
5	+/-125°	172°/s
6	+/-350°	219°/s

Axis data, KR 150 R3300 K prime

Axis	Range of motion, software-limited	Speed with rated payload
1	+/-185°	105°/s
2	-120° to +70°	107°/s
3	-120° to +155°	114°/s
4	+/-350°	179°/s

Axis	Range of motion, software-limited	Speed with rated payload
5	+/-125°	172°/s
6	+/-350°	219°/s

**Axis data,
KR 120 R3500 K
prime**

Axis	Range of motion, software-limited	Speed with rated payload
1	+/-185°	105°/s
2	-120° to +70°	107°/s
3	-120° to +155°	114°/s
4	+/-350°	292°/s
5	+/-125°	258°/s
6	+/-350°	284°/s

**Axis data,
KR 90 R3700 K
prime**

Axis	Range of motion, software-limited	Speed with rated payload
1	+/-185°	105°/s
2	-120° to +70°	107°/s
3	-120° to +155°	114°/s
4	+/-350°	292°/s
5	+/-125°	258°/s
6	+/-350°	284°/s

**Working
envelope**

The following diagrams show the shape and size of the working envelope for the "prime" variants.

The reference point for the working envelope is the intersection of axes 4 and 5.

Maße / Dimensions: mm

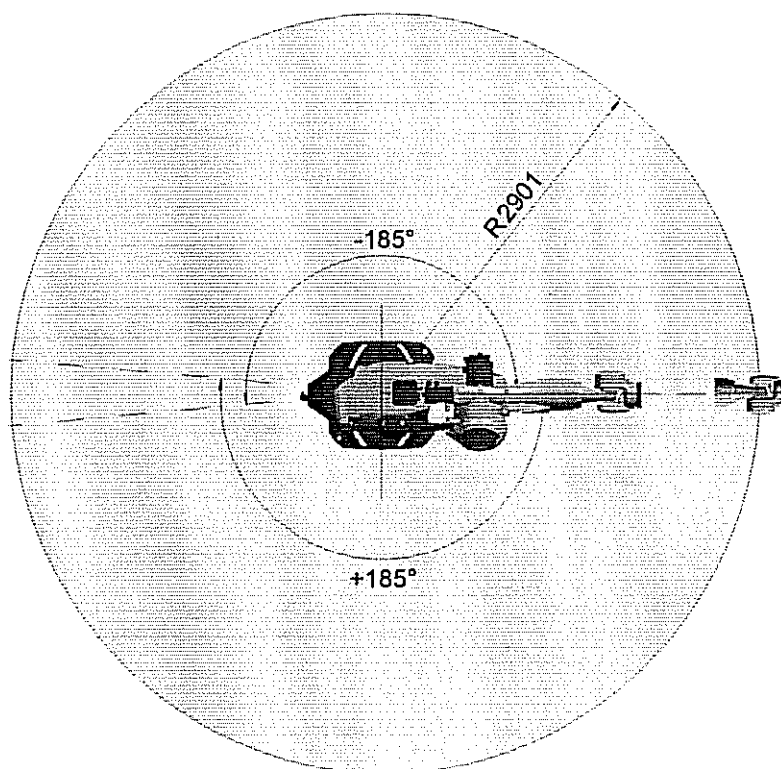
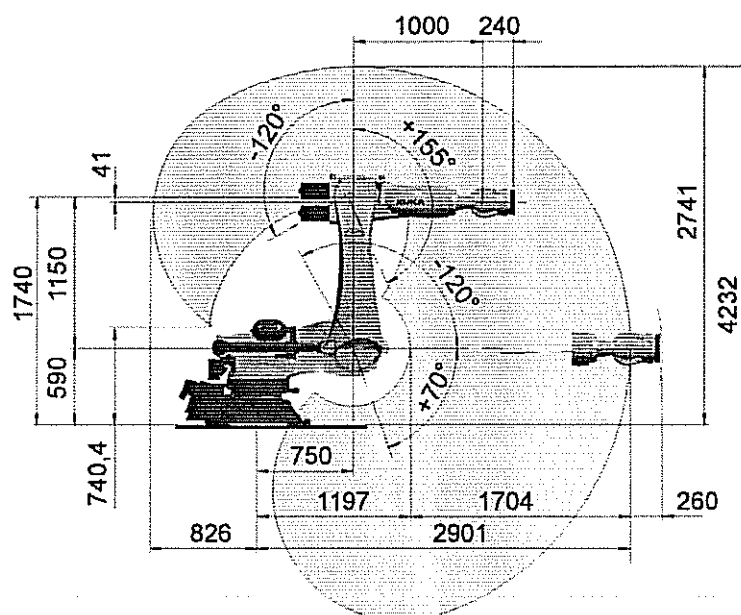


Fig. 4-1: Working envelope, KR 210 R2900 K prime

Maße / Dimensions: mm

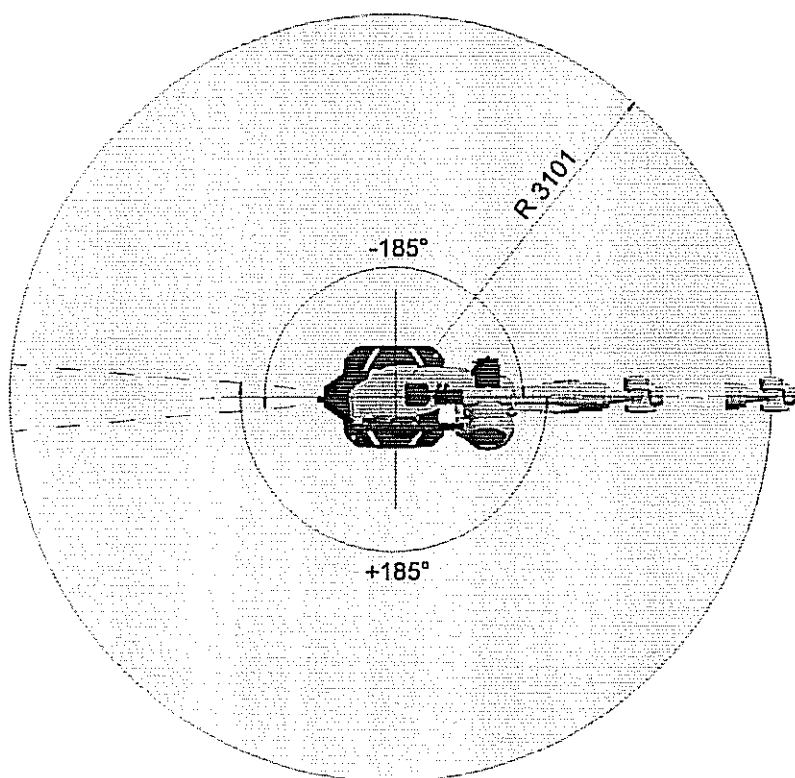
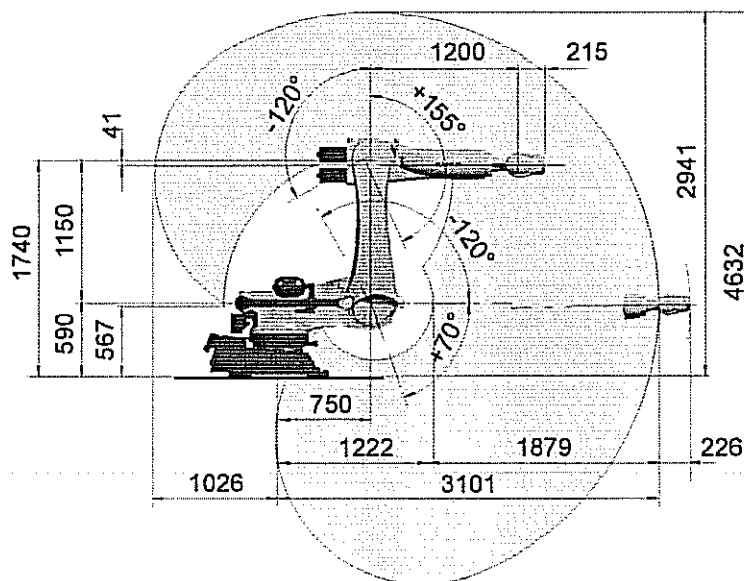


Fig. 4-2: Working envelope, KR 180 R3100 K prime

Maße / Dimensions: mm

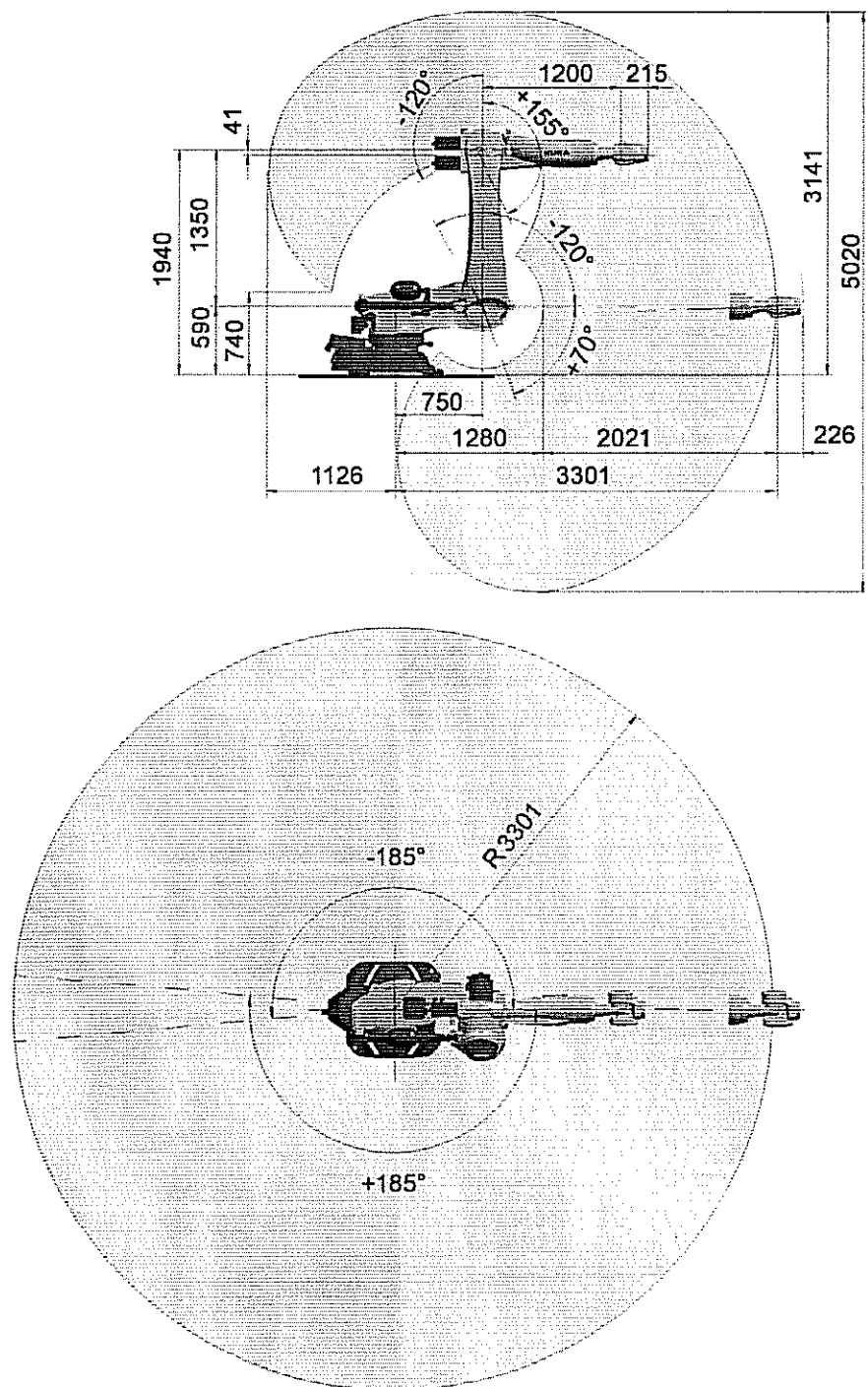


Fig. 4-3: Working envelope, KR 150 R3300 K prime

Maße / Dimensions: mm

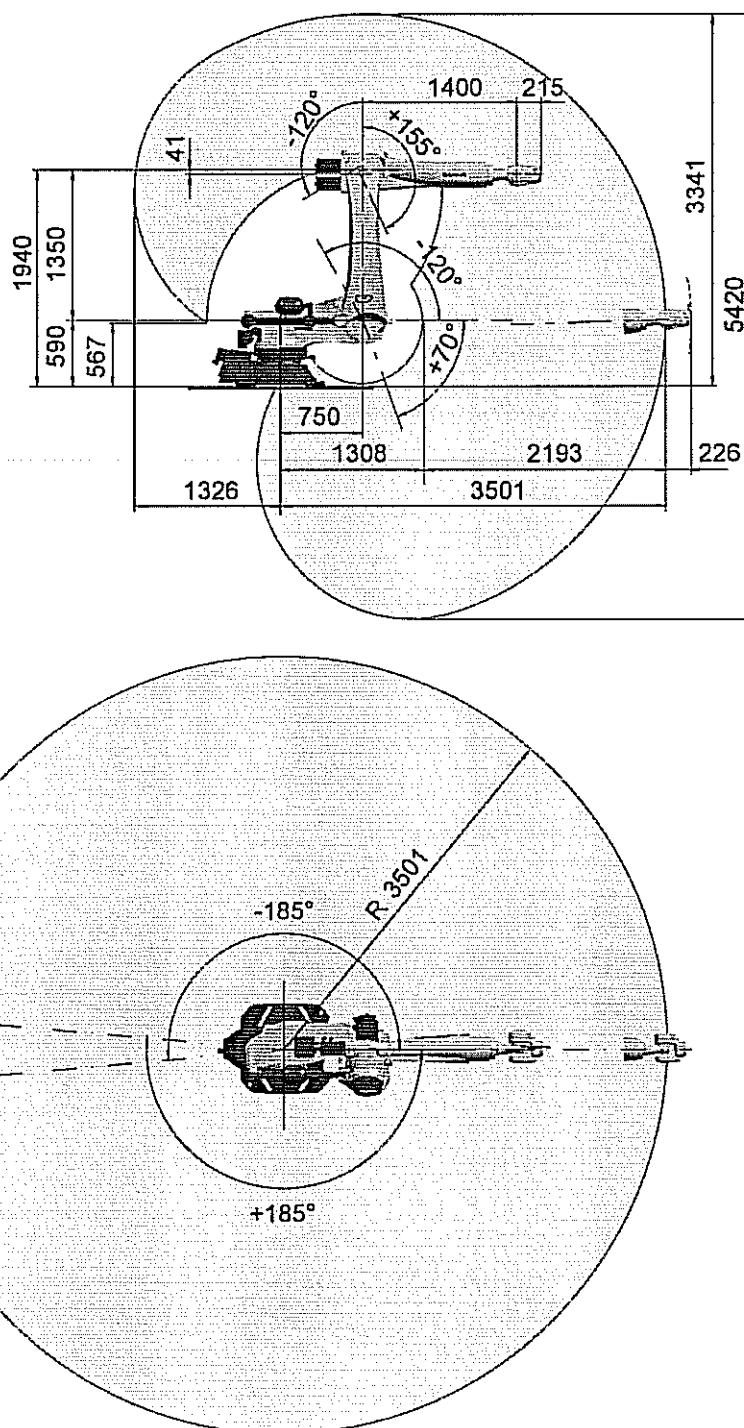


Fig. 4-4: Working envelope, KR 120 R3500 K prime

Maße / Dimensions: mm

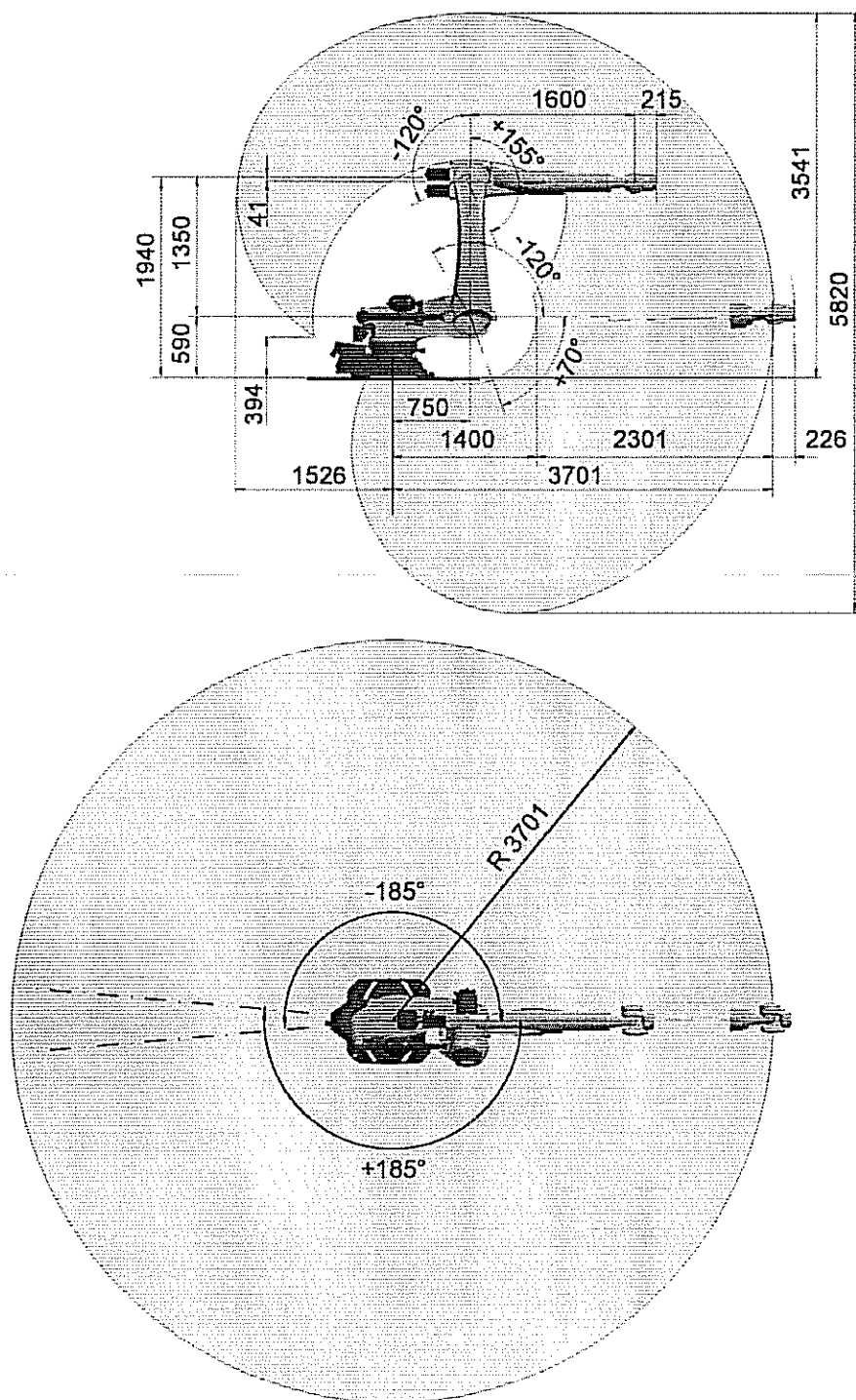


Fig. 4-5: Working envelope, KR 90 R3700 K prime

4.3 Payloads

Payloads, KR 210
R2900 K prime

Robot	KR 210 R2900 K prime
In-line wrist	IW 210/240
Rated payload	210 kg

Distance of the load center of gravity L_z (horizontal)	240 mm
Distance of the load center of gravity L_{xy} (vertical)	270 mm
Permissible mass moment of inertia	105 kgm ²
Max. total load	260 kg
Supplementary load on arm	50 kg
Supplementary load on link arm	On request
Supplementary load on rotating column	On request
Supplementary load on base frame	On request

Payloads, KR 180 R3100 K prime

Robot	KR 180 R3100 K prime
In-line wrist	IW 150/180/210
Rated payload	180 kg
Distance of the load center of gravity L_z (horizontal)	240 mm
Distance of the load center of gravity L_{xy} (vertical)	270 mm
Permissible mass moment of inertia	90 kgm ²
Max. total load	230 kg
Supplementary load on arm	50 kg
Supplementary load on link arm	On request
Supplementary load on rotating column	On request
Supplementary load on base frame	On request

Payloads, KR 150 R3300 K prime

Robot	KR 150 R3300 K prime
In-line wrist	IW 150/180/210
Rated payload	150 kg
Distance of the load center of gravity L_z (horizontal)	240 mm
Distance of the load center of gravity L_{xy} (vertical)	270 mm
Permissible mass moment of inertia	75 kgm ²
Max. total load	200 kg
Supplementary load on arm	50 kg
Supplementary load on link arm	On request
Supplementary load on rotating column	On request
Supplementary load on base frame	On request

Payloads, KR 120 R3500 K prime

Robot	KR 120 R3500 K prime
In-line wrist	IW 90/120
Rated payload	120 kg
Distance of the load center of gravity L_z (horizontal)	240 mm
Distance of the load center of gravity L_{xy} (vertical)	270 mm
Permissible mass moment of inertia	60 kgm ²
Max. total load	170 kg
Supplementary load on arm	50 kg
Supplementary load on link arm	On request
Supplementary load on rotating column	On request
Supplementary load on base frame	On request

Payloads, KR 90 R3700 K prime

Robot	KR 90 R3700 K prime
In-line wrist	IW 90/120
Rated payload	90 kg
Distance of the load center of gravity L_z (horizontal)	240 mm
Distance of the load center of gravity L_{xy} (vertical)	270 mm
Permissible mass moment of inertia	45 kgm ²
Max. total load	140 kg
Supplementary load on arm	50 kg
Supplementary load on link arm	On request
Supplementary load on rotating column	On request
Supplementary load on base frame	On request

Load center of gravity P

For all payloads, the load center of gravity refers to the distance from the face of the mounting flange on axis 6. Refer to the payload diagram for the nominal distance.

Payload diagram

NOTICE

This loading curve corresponds to the maximum load capacity. Both values (payload and mass moment of inertia) must be checked in all cases. Exceeding this capacity will reduce the service life of the robot and overload the motors and the gears; in any such case the KUKA Roboter GmbH must be consulted beforehand.

The values determined here are necessary for planning the robot application. For commissioning the robot, additional input data are required in accordance with operating and programming instructions of the KUKA System Software.

The mass inertia must be verified using KUKA.Load. It is imperative for the load data to be entered in the robot controller!

Maße / Dimensions: mm

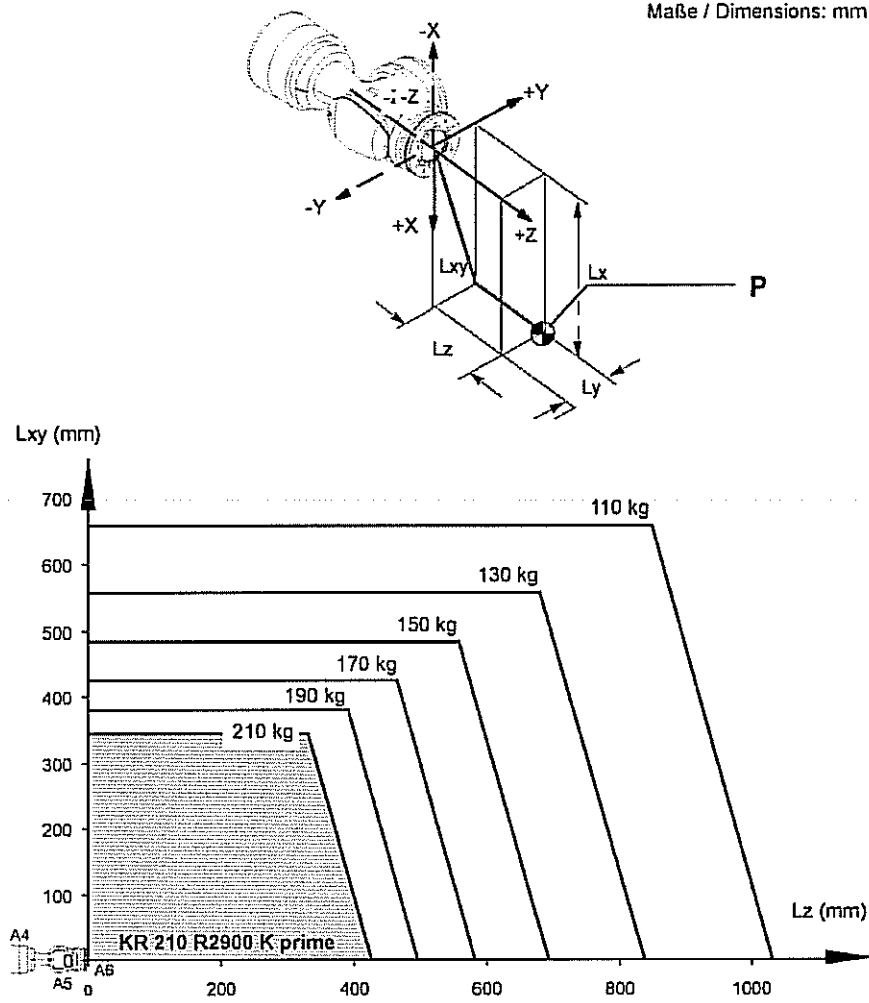


Fig. 4-6: Payload diagram

Maße / Dimensions: mm

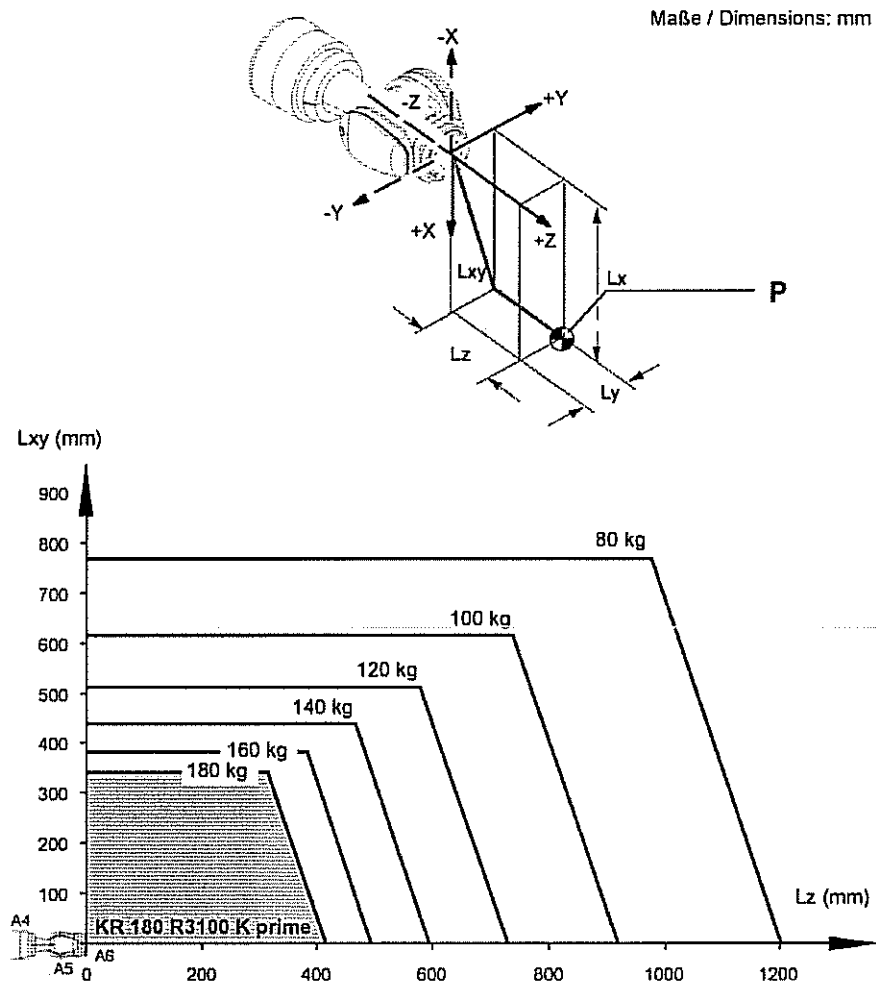


Fig. 4-7: Payload diagram

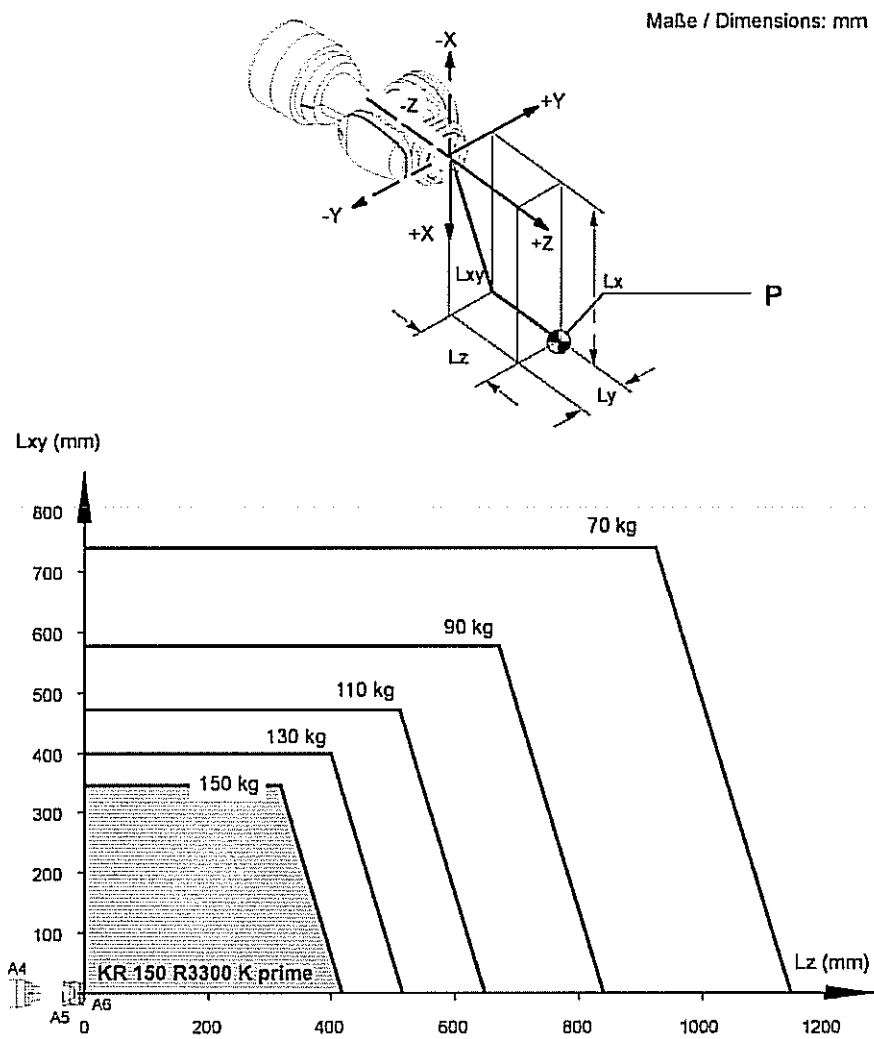


Fig. 4-8: Payload diagram

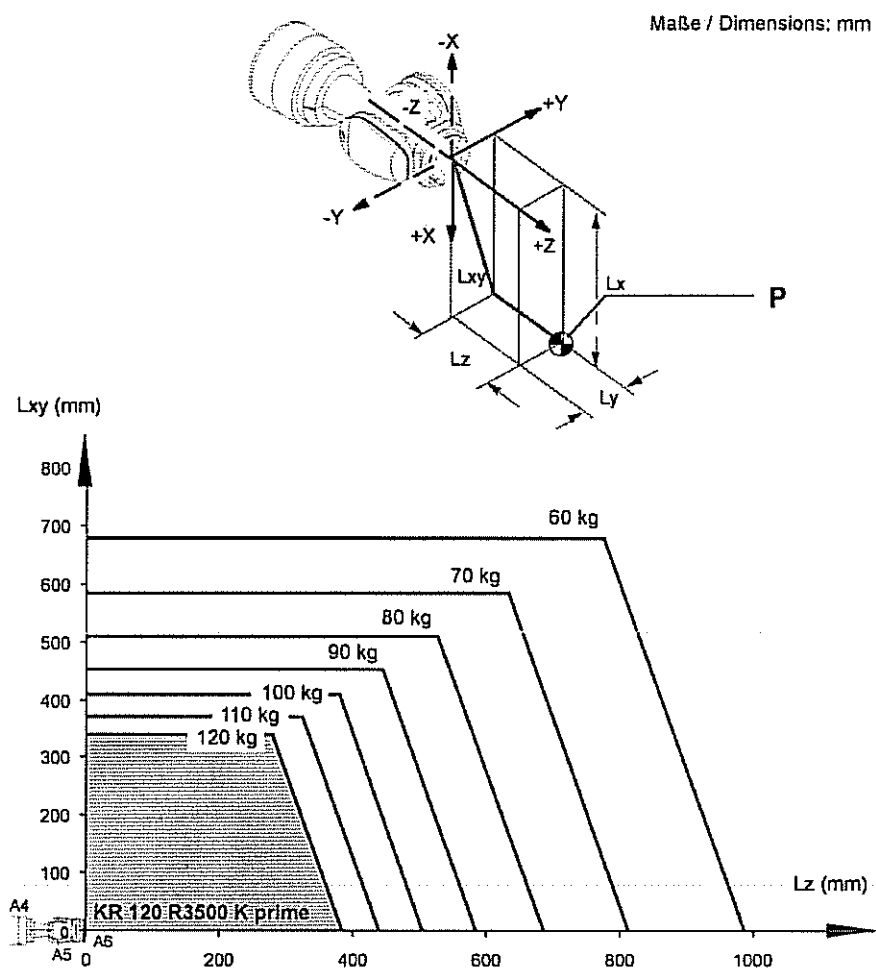


Fig. 4-9: Payload diagram

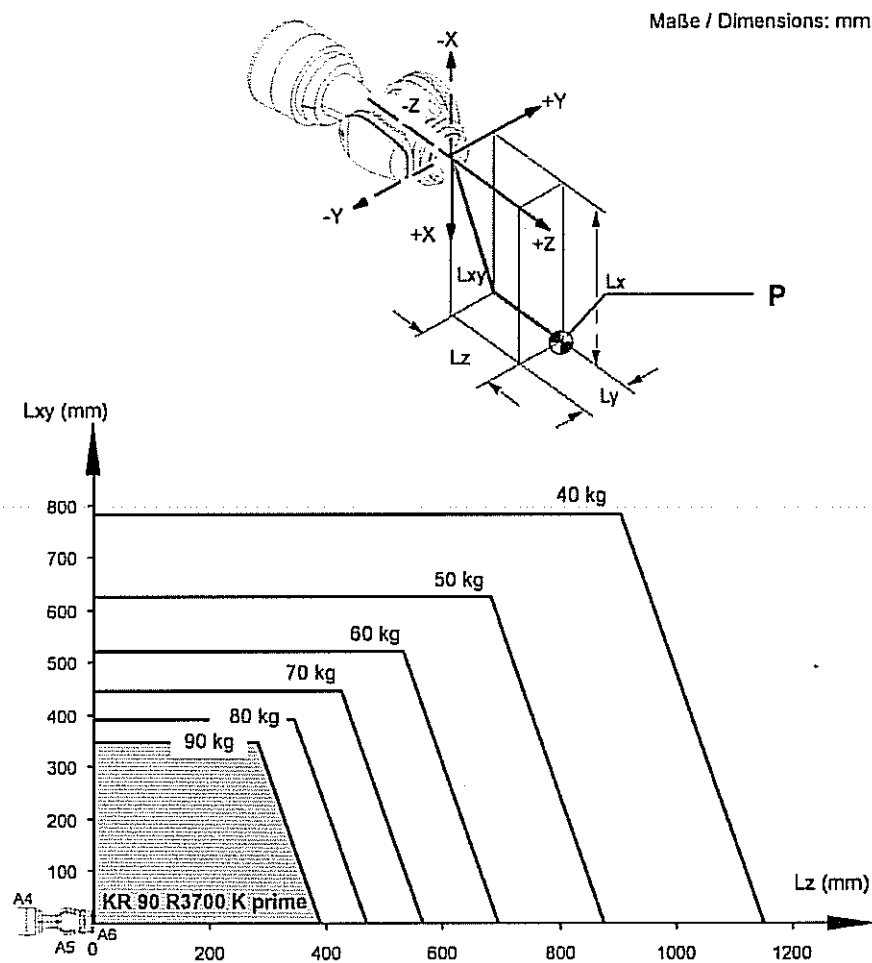


Fig. 4-10: Payload diagram

Mounting flange
D=125

Robot type	KR 180 R310 K prime KR 150 R3300 K prime KR 120 R3500 K prime KR 90 R3700 K prime
In-line wrist type	IW 150/180/210 IW 90/120
Mounting flange (hole circle)	125 mm
Screw grade	10.9
Screw size	M10
Number of fastening threads	11
Grip length	1.5 x nominal diameter
Depth of engagement	min. 12 mm, max. 16 mm
Locating element	10 ^{H7}

The mounting flange is depicted (>>> Fig. 4-11) with axes 4 and 6 in the zero position. The symbol X_m indicates the position of the locating element (bushing) in the zero position.

Maße / Dimensions: mm

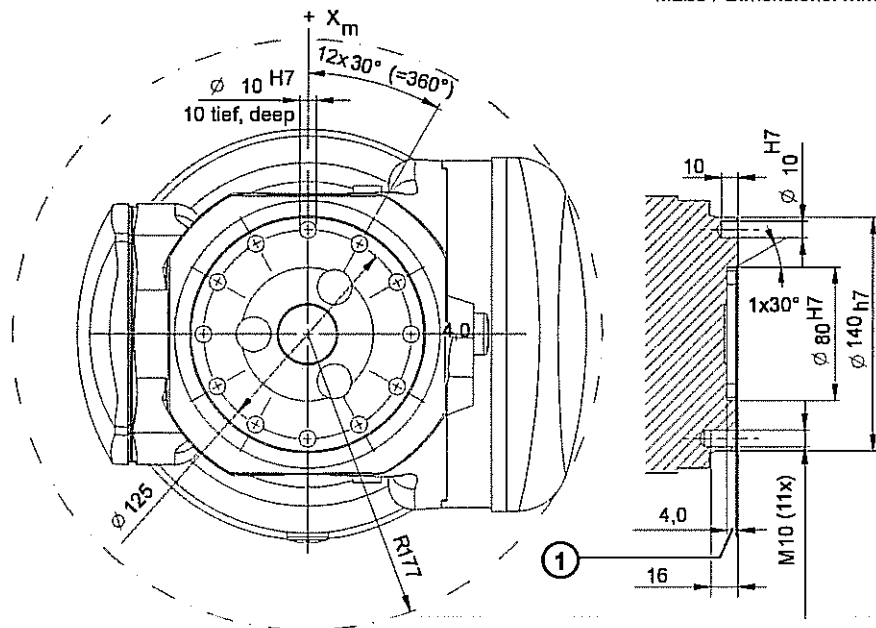


Fig. 4-11: Mounting flange D=125

1 Fitting length

Mounting flange
D=160

Robot type	KR 210 R2900 K prime
In-line wrist	IW 210/240
Mounting flange (hole circle)	160 mm
Screw grade	10.9
Screw size	M10
Number of fastening threads	11
Grip length	1.5 x nominal diameter
Depth of engagement	min. 12 mm, max. 16 mm
Locating element	10 ^{H7}

The mounting flange is depicted (>>> Fig. 4-12) with axes 4 and 6 in the zero position. The symbol X_m indicates the position of the locating element (bushing) in the zero position.

1 Fitting length

Supplementary load

The robot can carry supplementary loads (>>> Fig. 4-14) on the arm. When mounting the supplementary loads, be careful to observe the maximum permissible total load. The dimensions and positions of the installation options can be seen in the following diagram.

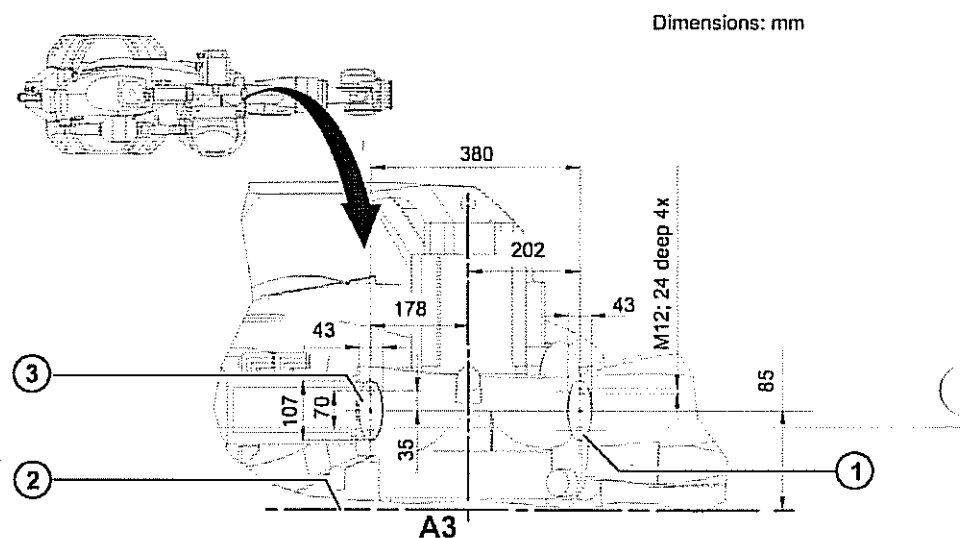


Fig. 4-14: Supplementary load on arm

- | | | | |
|---|---------------------------|---|------------------|
| 1 | Fastening thread | 3 | Mounting surface |
| 2 | Interference contour, arm | | |

4.4 Loads acting on the mounting base

Loads acting on the mounting base

The specified forces and moments already include the payload and the inertia force (weight) of the robot.

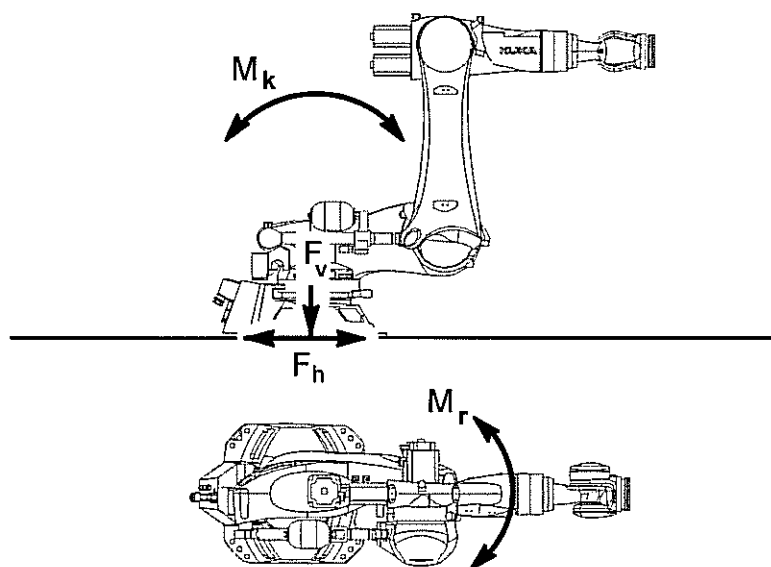


Fig. 4-15: Loads acting on the mounting base

All variants	Force/torque/mass
F_v = vertical force	$F_{vmax} = 24,000 \text{ N}$
F_h = horizontal force	$F_{hmax} = 16,000 \text{ N}$
M_k = tilting moment	$M_{kmax} = 49,000 \text{ Nm}$
M_r = torque	$M_{rmax} = 35,000 \text{ Nm}$
Total mass for load acting on the mounting base	KR 210 R2900 K prime 1,390 kg KR 180 R3100 K prime 1,389 kg KR 150 R3300 K prime 1,338 kg KR 120 R3500 K prime 1,362 kg KR 90 R3700 K prime 1,344 kg
Robot	KR 210 R2900 K prime 1,180 kg KR 180 R3100 K prime 1,168 kg KR 150 R3300 K prime 1,184 kg KR 120 R3500 K prime 1,192 kg KR 150 R3700 K prime 1,204 kg
Total load (suppl. load on arm + rated payload)	KR 210 R2900 K prime 260 kg KR 180 R3100 K prime 230 kg KR 150 R3300 K prime 200 kg KR 120 R3500 K prime 170 kg KR 90 R3700 K prime 140 kg

NOTICE The mounting base loads specified in the table are the maximum loads that may occur. They must be referred to when dimensioning the mounting bases and must be adhered to for safety reasons.

The supplementary loads on the base frame and rotating column are not taken into consideration in the calculation of the mounting base load. These supplementary loads must be taken into consideration for F_v .

4.5 Transport dimensions

The transport dimensions for the robot (1) can be noted from the following diagram. The position of the center of gravity (2) and the weight vary according to the specific configuration. The specified dimensions refer to the robot without equipment. The following diagram shows the dimensions of the robot when it stands on the floor without wooden transport blocks.

Dimensions: mm

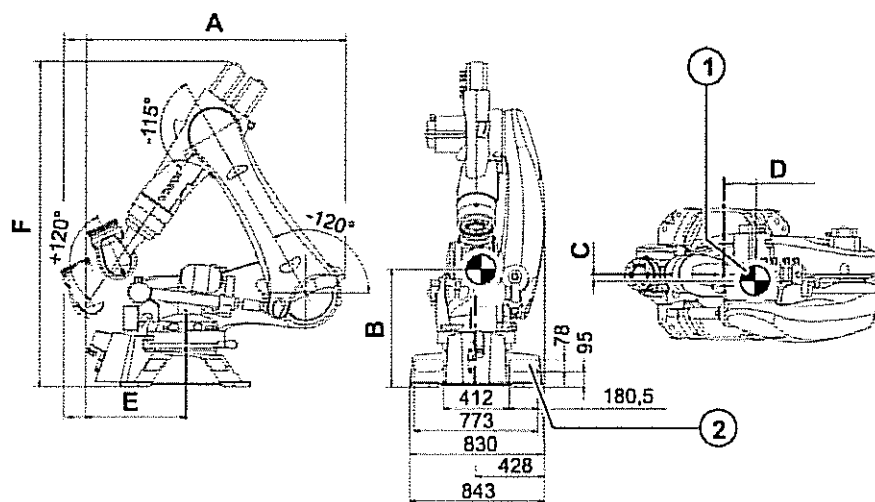


Fig. 4-16: Transport dimensions

- 1 Center of gravity
- 2 Robot

Transport dimensions and centers of gravity

Robot with reach	A	B	C	D	E	F
R2900	1628	737	41	190	630	2042
R3100	1701	722	43	187	703	2042
R3300	1801	778	46	165	803	2215
R3500	1916	766	46	151	918	2215
R3700	2031	766	45	140	1032	2215

4.6 Plates and labels

Plates and labels The following plates and labels (>>> Fig. 4-17) are attached to the robot. They must not be removed or rendered illegible. Illegible plates and labels must be replaced.

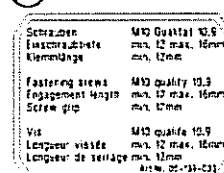
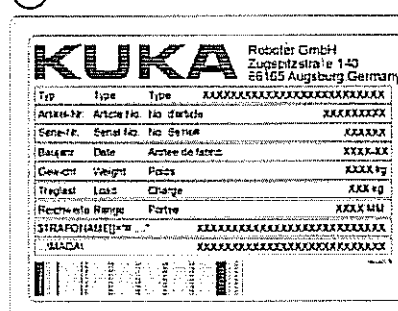
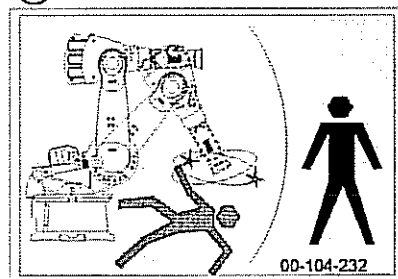
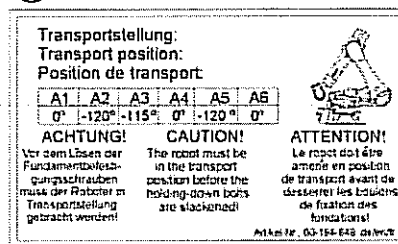
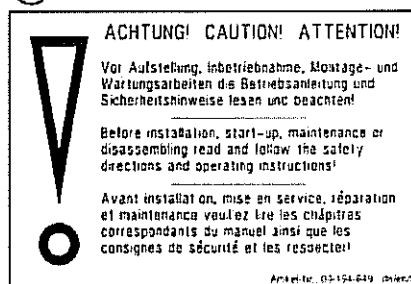
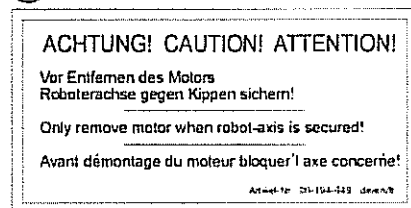
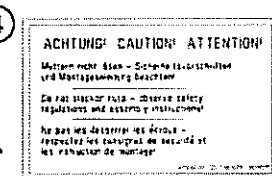
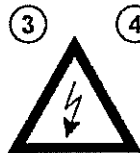
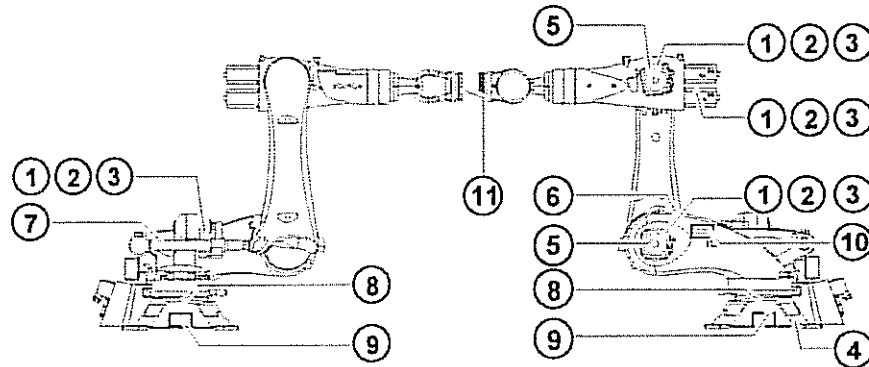


Fig. 4-17: Plates and labels

4.7 Stopping distances and times

4.7.1 Terms used

Term	Description
m	Mass of the rated load and the supplementary load on the arm.
Phi	Angle of rotation (°) about the corresponding axis. This value can be entered in the controller via the KCP and is displayed on the KCP.
POV	Program override (%) = velocity of the robot motion. This value can be entered in the controller via the KCP and is displayed on the KCP.
Extension	Distance (l in %) (>>> Fig. 4-18) between axis 1 and the intersection of axes 4 and 5. With parallelogram robots, the distance between axis 1 and the intersection of axis 6 and the mounting flange.
KCP	The KCP teach pendant has all the operator control and display functions required for operating and programming the robot system.

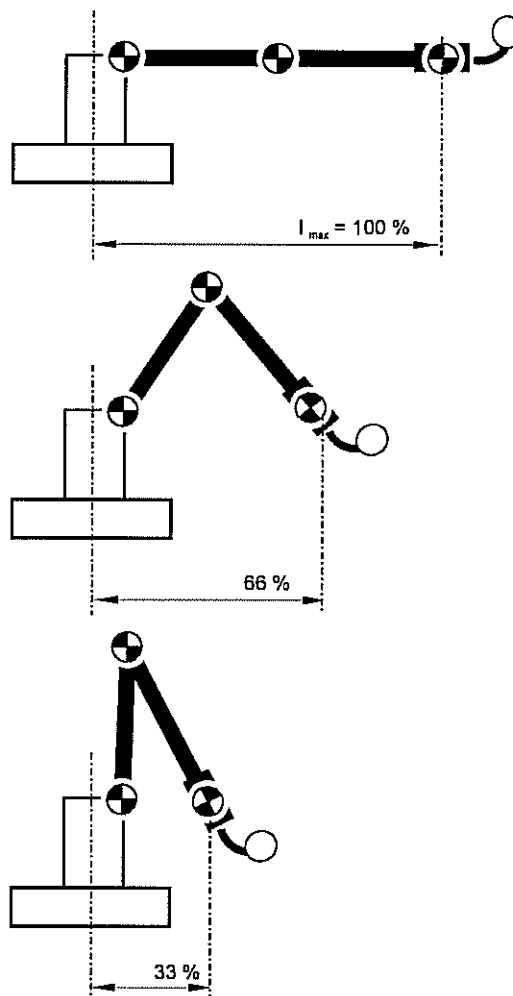


Fig. 4-18: Extension

4.7.2 Stopping distances and times, KR 210 R2900 K prime

4.7.2.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension l = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

	Stopping distance (°)	Stopping time (s)
Axis 1	64.29	1.115
Axis 2	67.60	1.169
Axis 3	50.36	0.654

4.7.2.2 Stopping distances and stopping times for STOP 1, axis 1

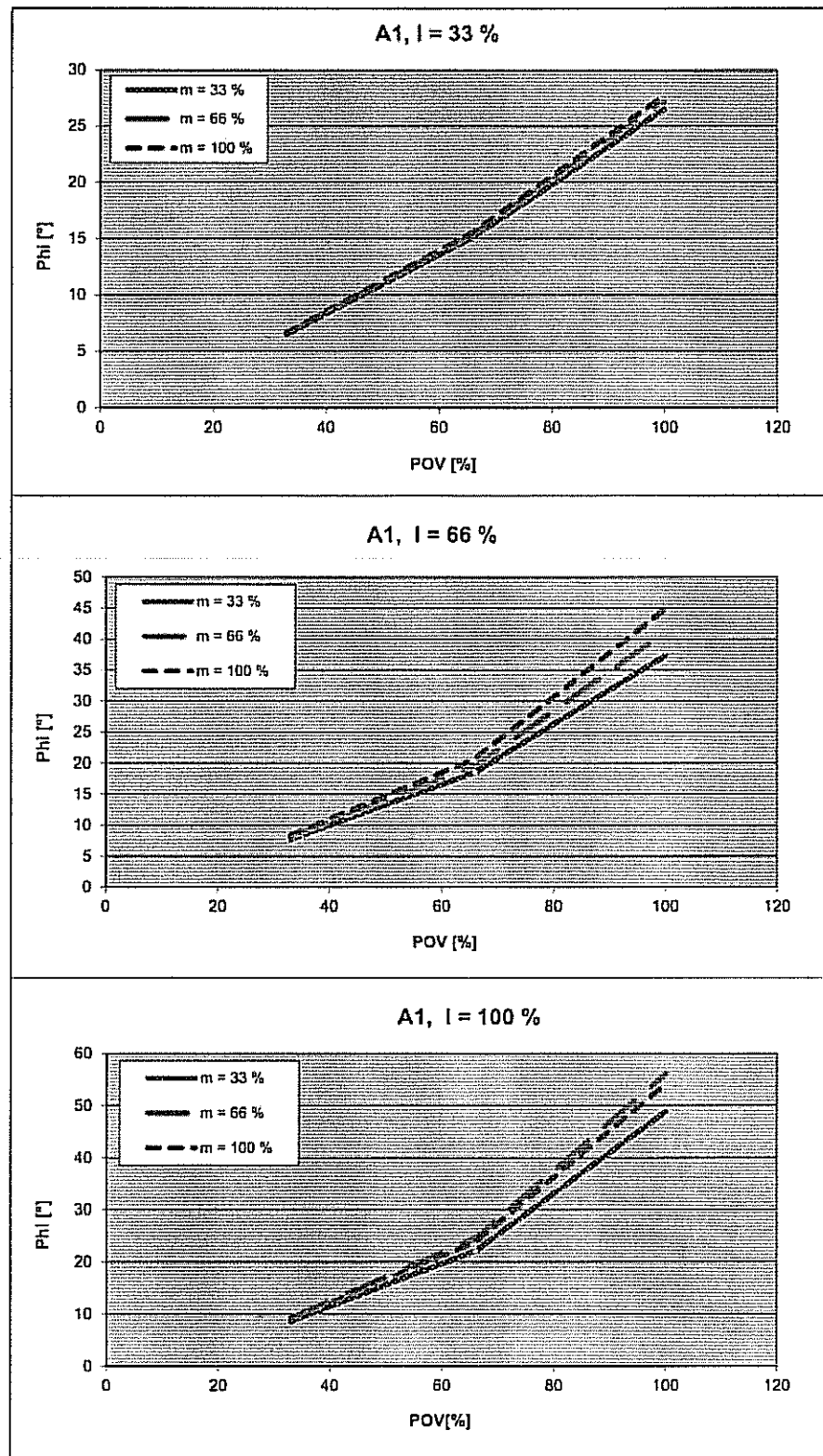


Fig. 4-19: Stopping distances for STOP 1, axis 1

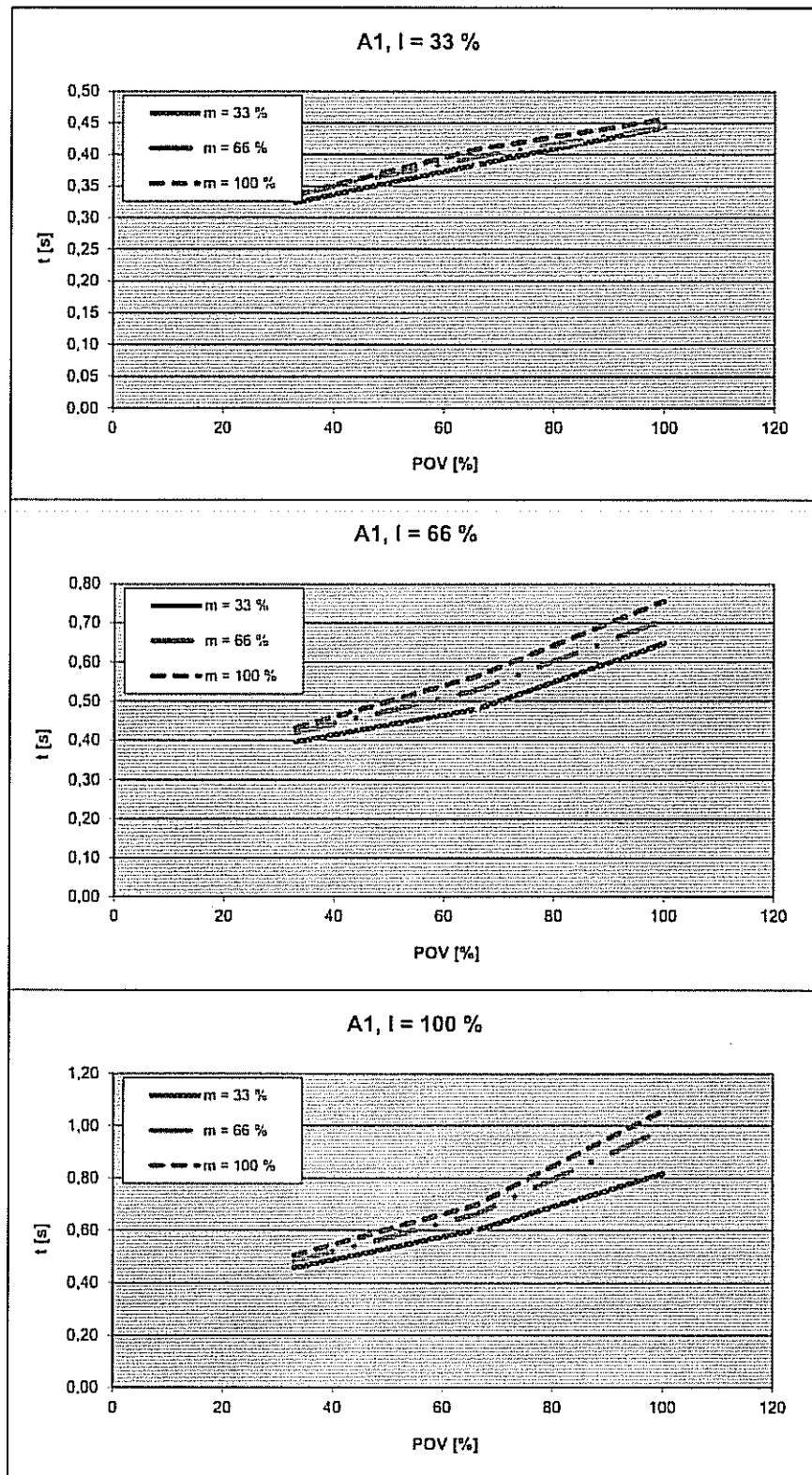


Fig. 4-20: Stopping times for STOP 1, axis 1

4.7.2.3 Stopping distances and stopping times for STOP 1, axis 2

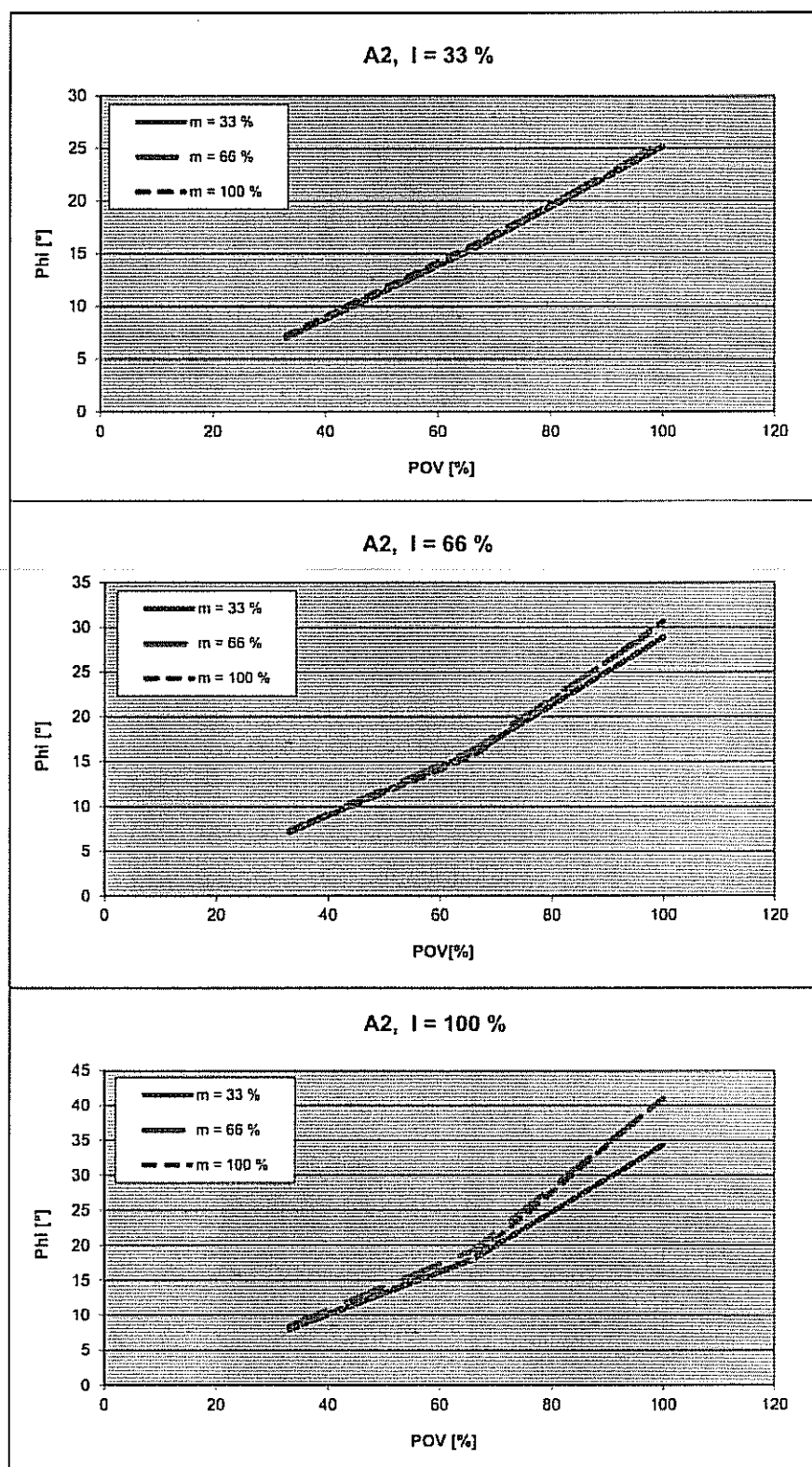


Fig. 4-21: Stopping distances for STOP 1, axis 2

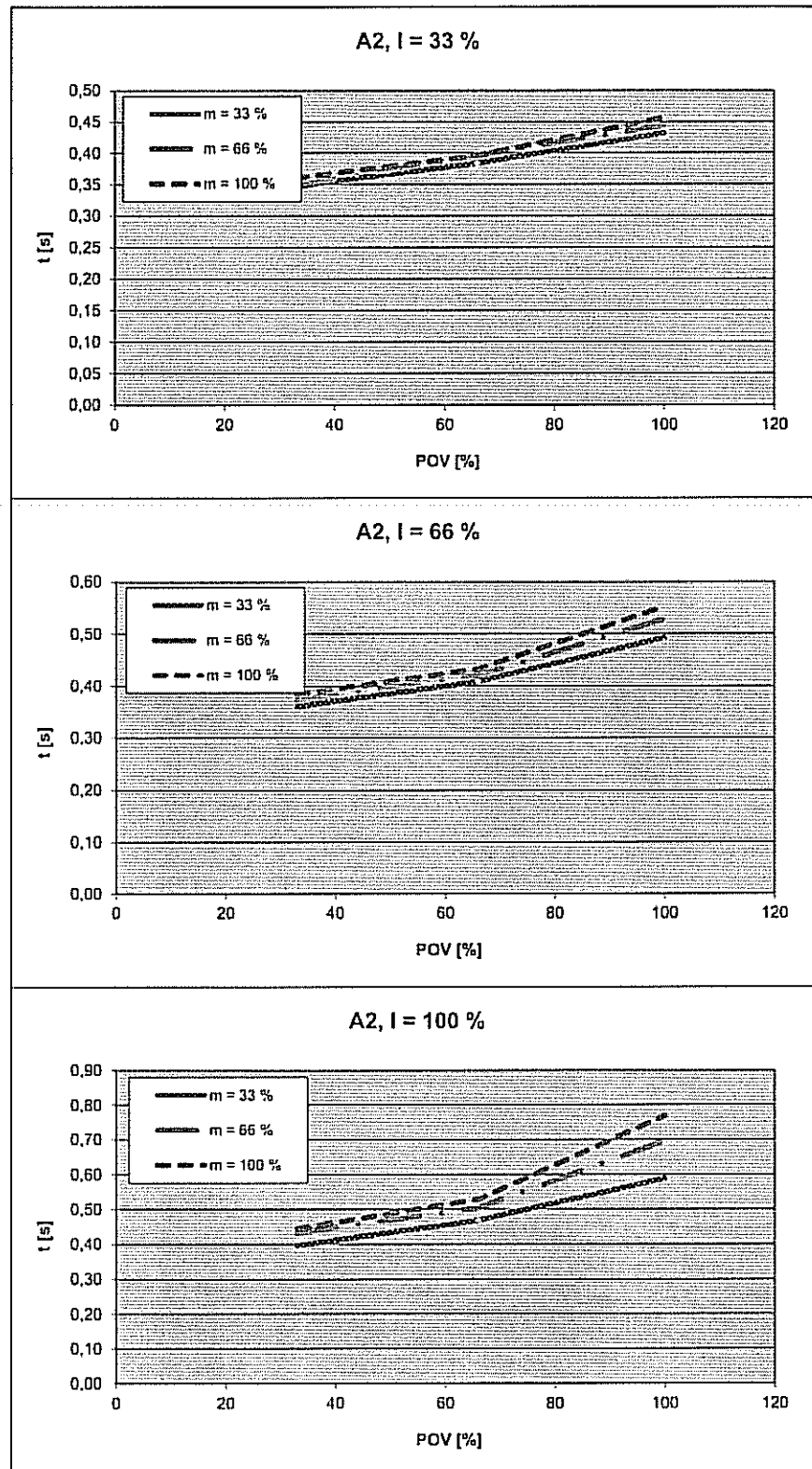


Fig. 4-22: Stopping times for STOP 1, axis 2

4.7.2.4 Stopping distances and stopping times for STOP 1, axis 3

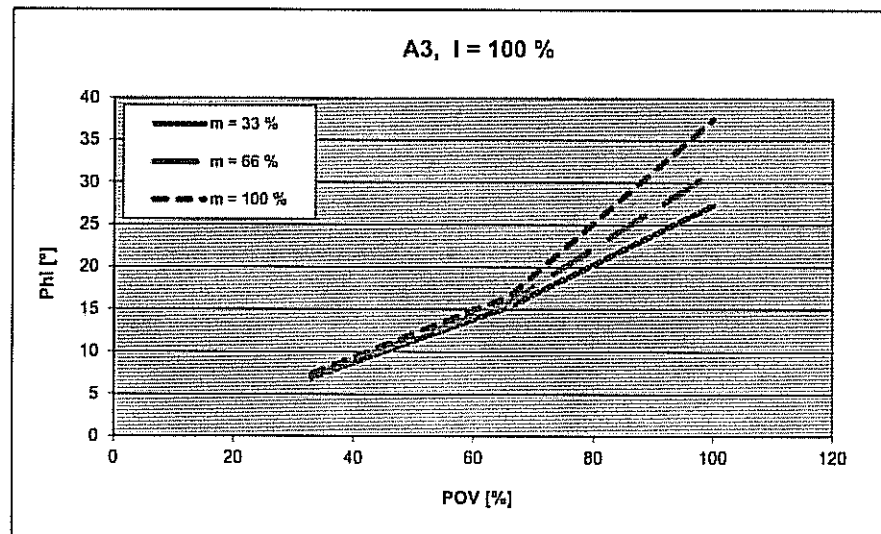


Fig. 4-23: Stopping distances for STOP 1, axis 3

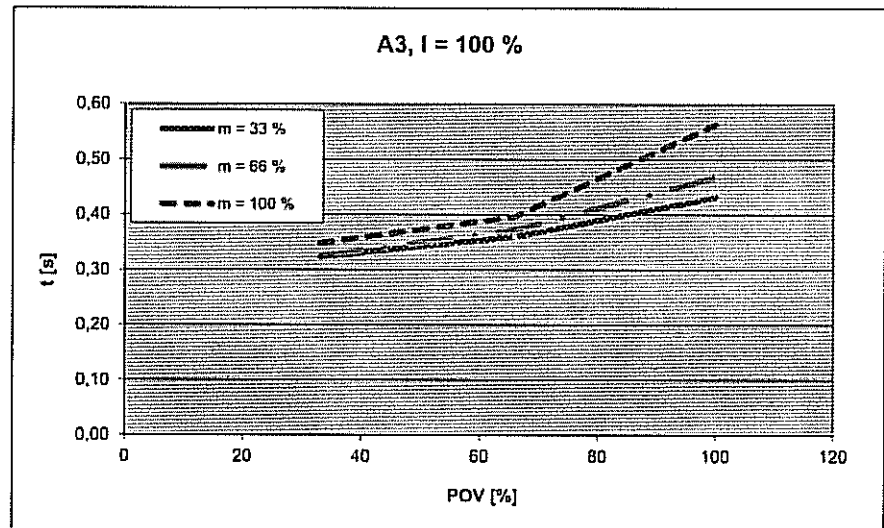


Fig. 4-24: Stopping times for STOP 1, axis 3

4.7.3 Stopping distances and times, KR 180 R3100 K prime

4.7.3.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension I = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

	Stopping distance (°)	Stopping time (s)
Axis 1	63.01	1.092
Axis 2	50.19	0.823
Axis 3	37.74	0.505

4.7.3.2 Stopping distances and stopping times for STOP 1, axis 1

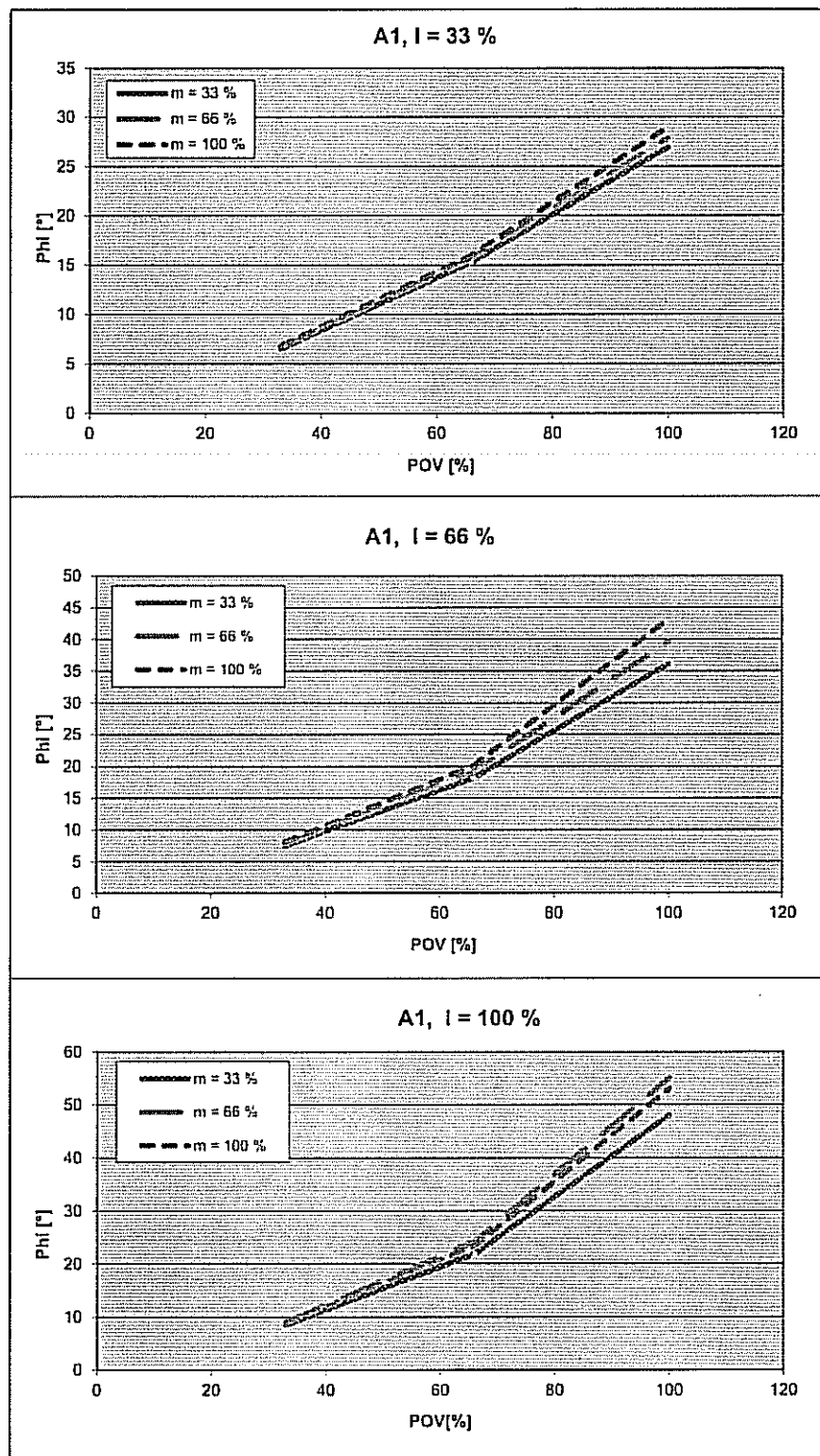


Fig. 4-25: Stopping distances for STOP 1, axis 1

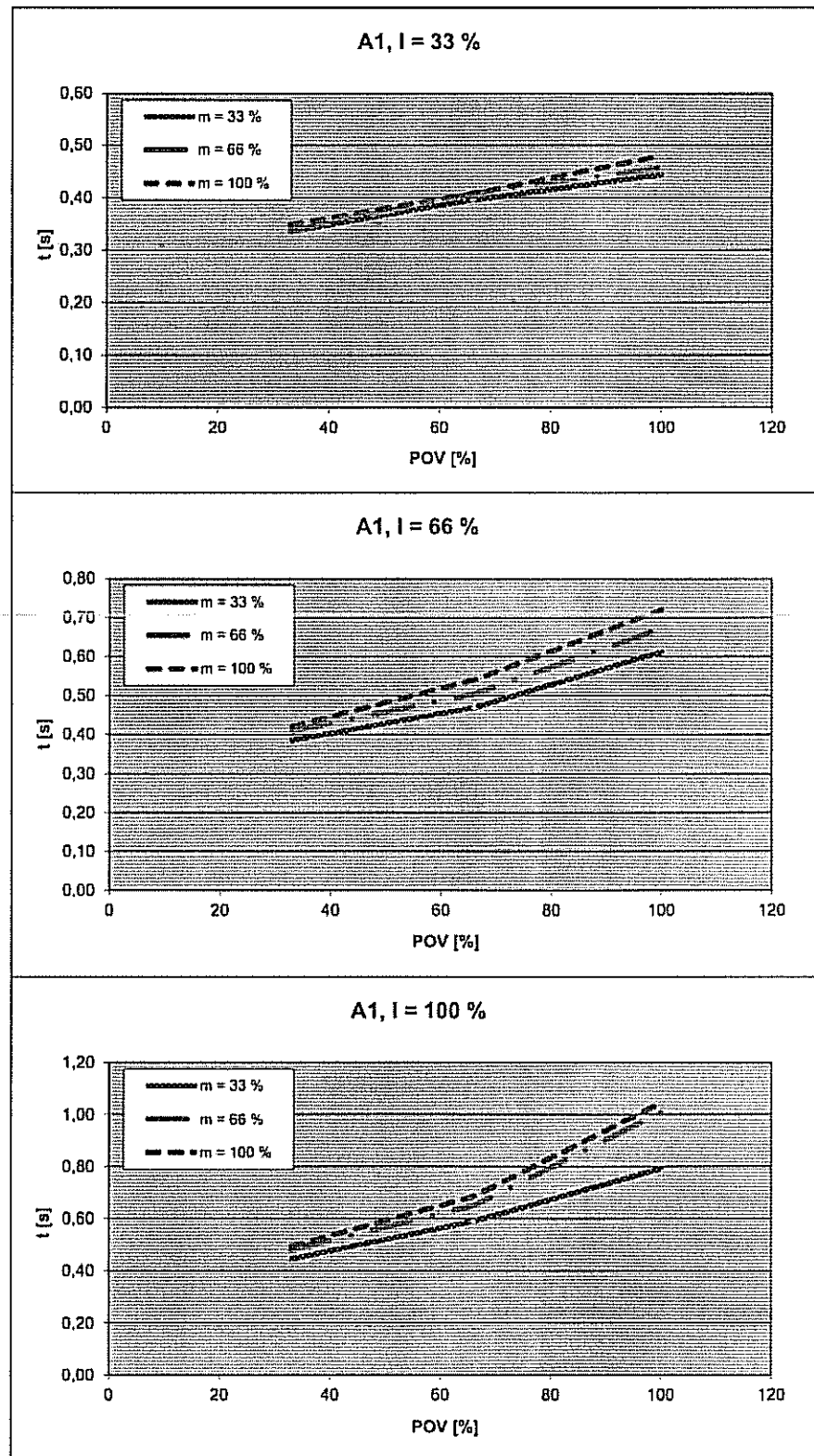


Fig. 4-26: Stopping times for STOP 1, axis 1

4.7.3.3 Stopping distances and stopping times for STOP 1, axis 2

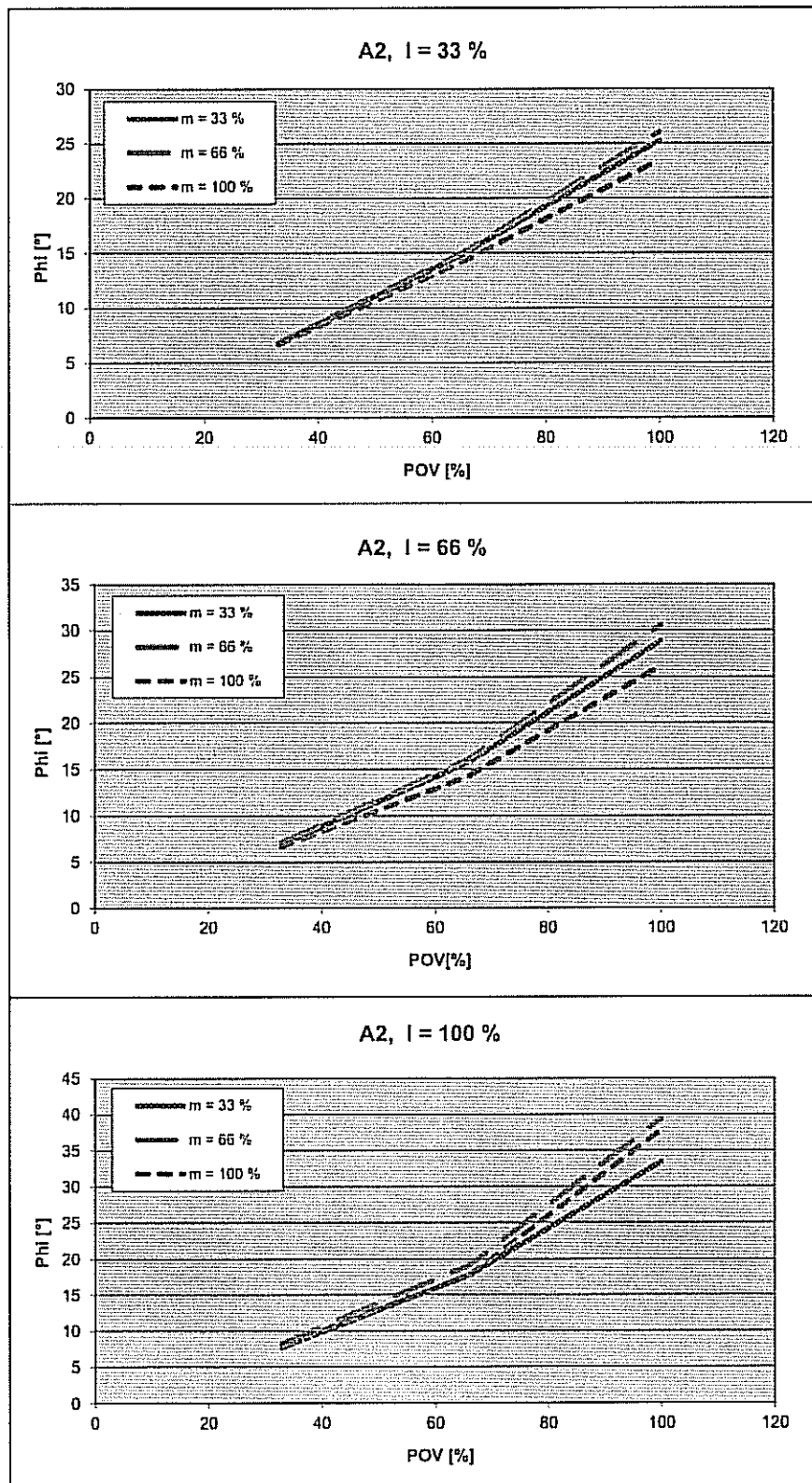


Fig. 4-27: Stopping distances for STOP 1, axis 2

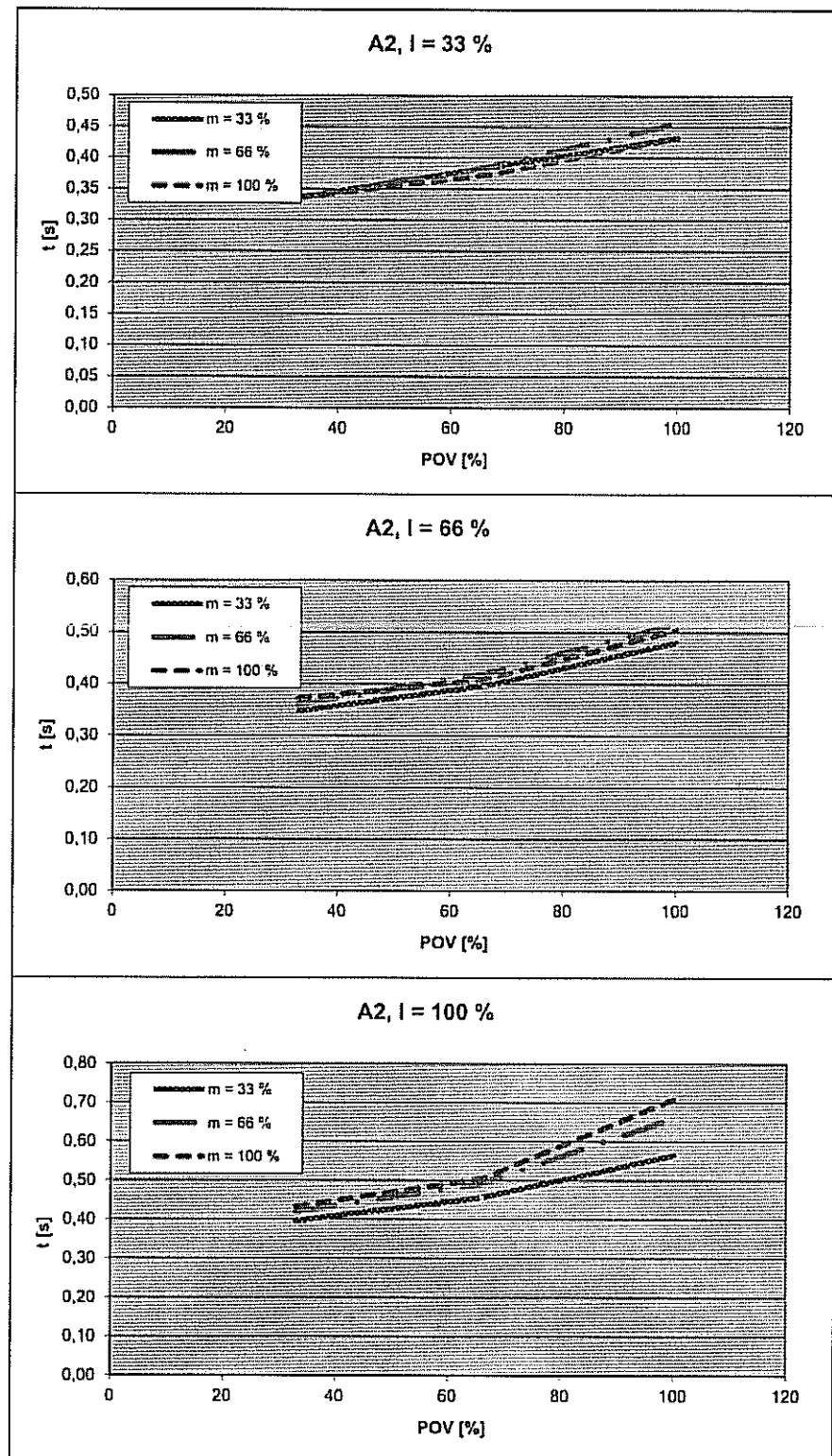


Fig. 4-28: Stopping times for STOP 1, axis 2

4.7.3.4 Stopping distances and stopping times for STOP 1, axis 3

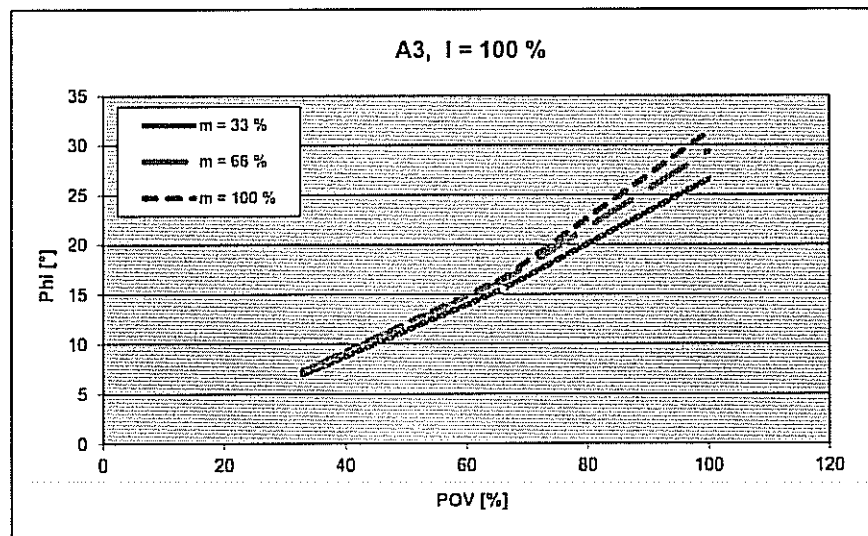


Fig. 4-29: Stopping distances for STOP 1, axis 3

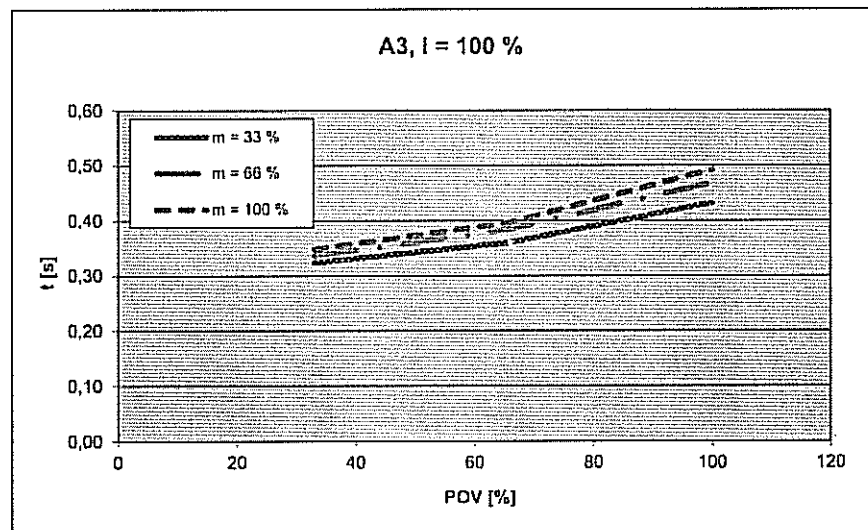


Fig. 4-30: Stopping times for STOP 1, axis 3

4.7.4 Stopping distances and times, KR 150 R3300 K prime

4.7.4.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension l = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

	Stopping distance (°)	Stopping time (s)
Axis 1	63.56	1.107
Axis 2	68.07	1.15
Axis 3	47.42	0.606

4.7.4.2 Stopping distances and stopping times for STOP 1, axis 1

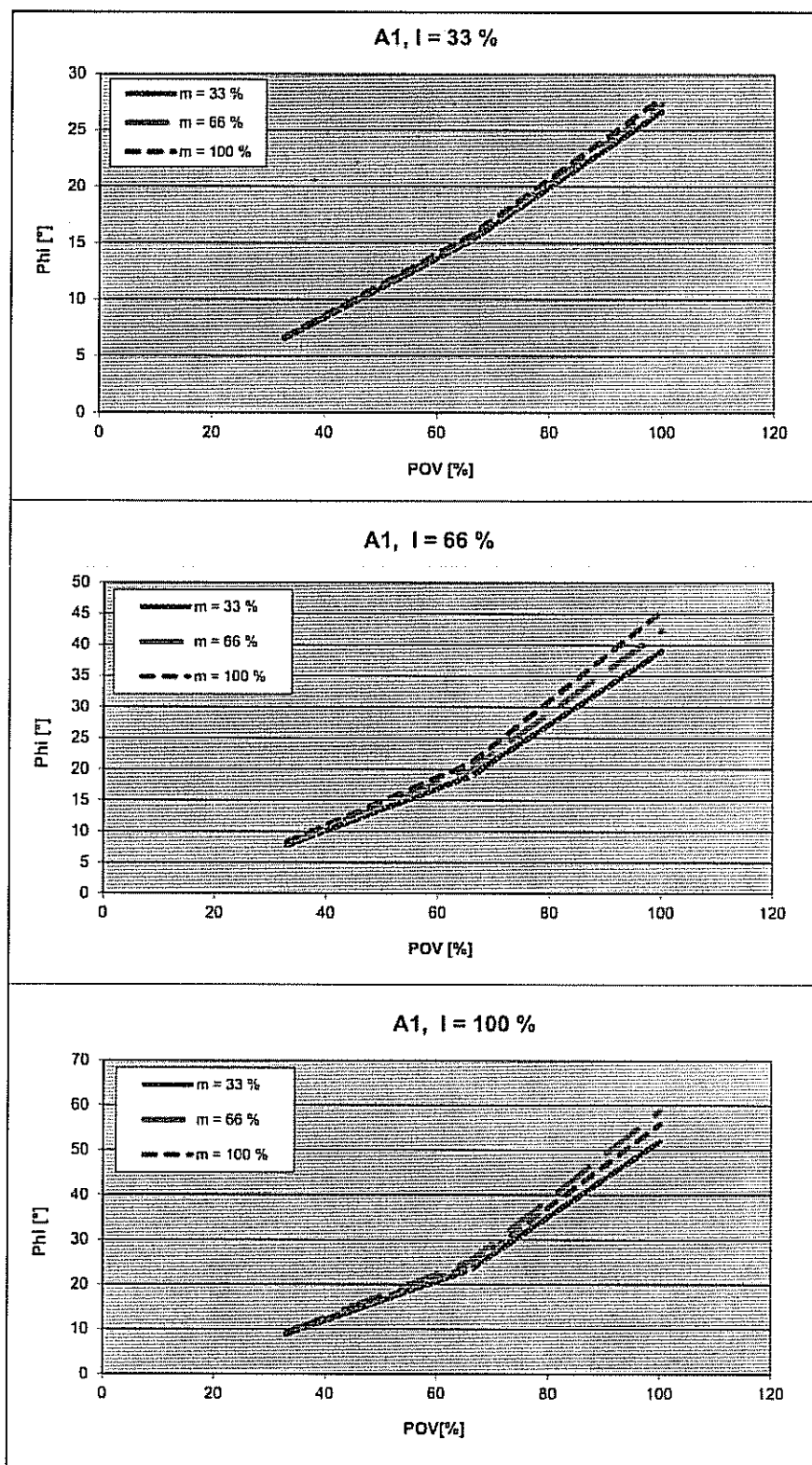


Fig. 4-31: Stopping distances for STOP 1, axis 1

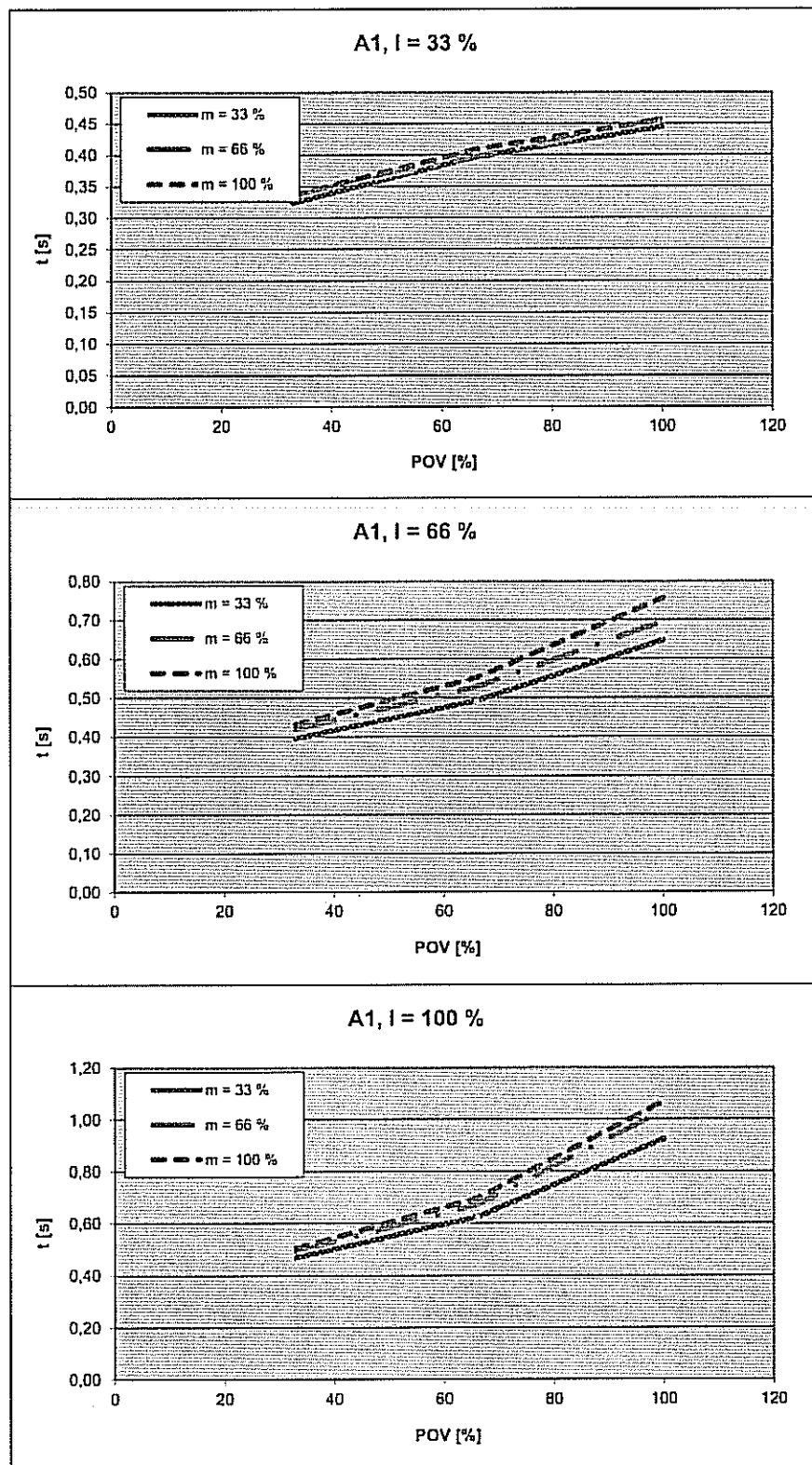


Fig. 4-32: Stopping times for STOP 1, axis 1

4.7.4.3 Stopping distances and stopping times for STOP 1, axis 2

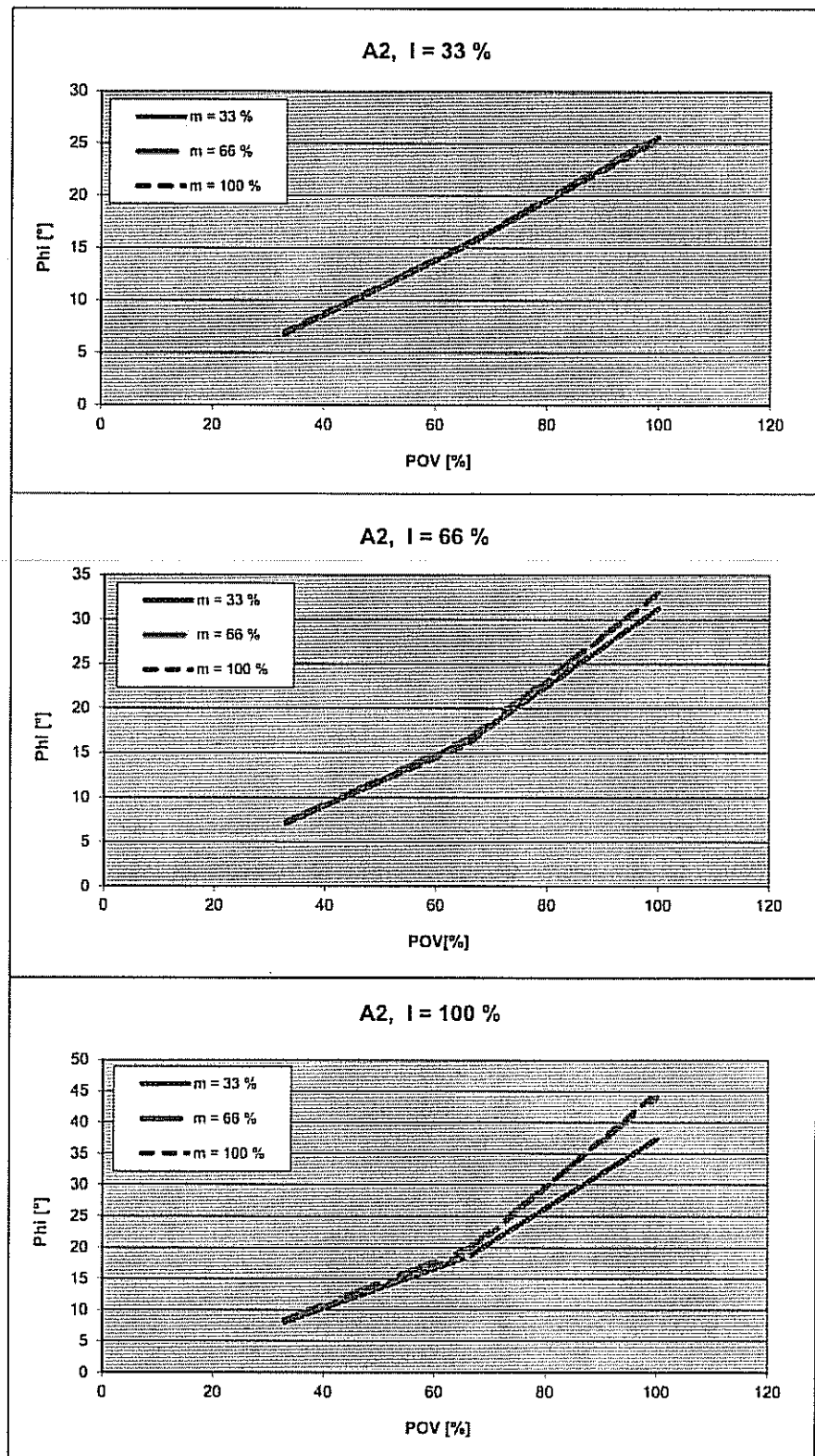


Fig. 4-33: Stopping distances for STOP 1, axis 2

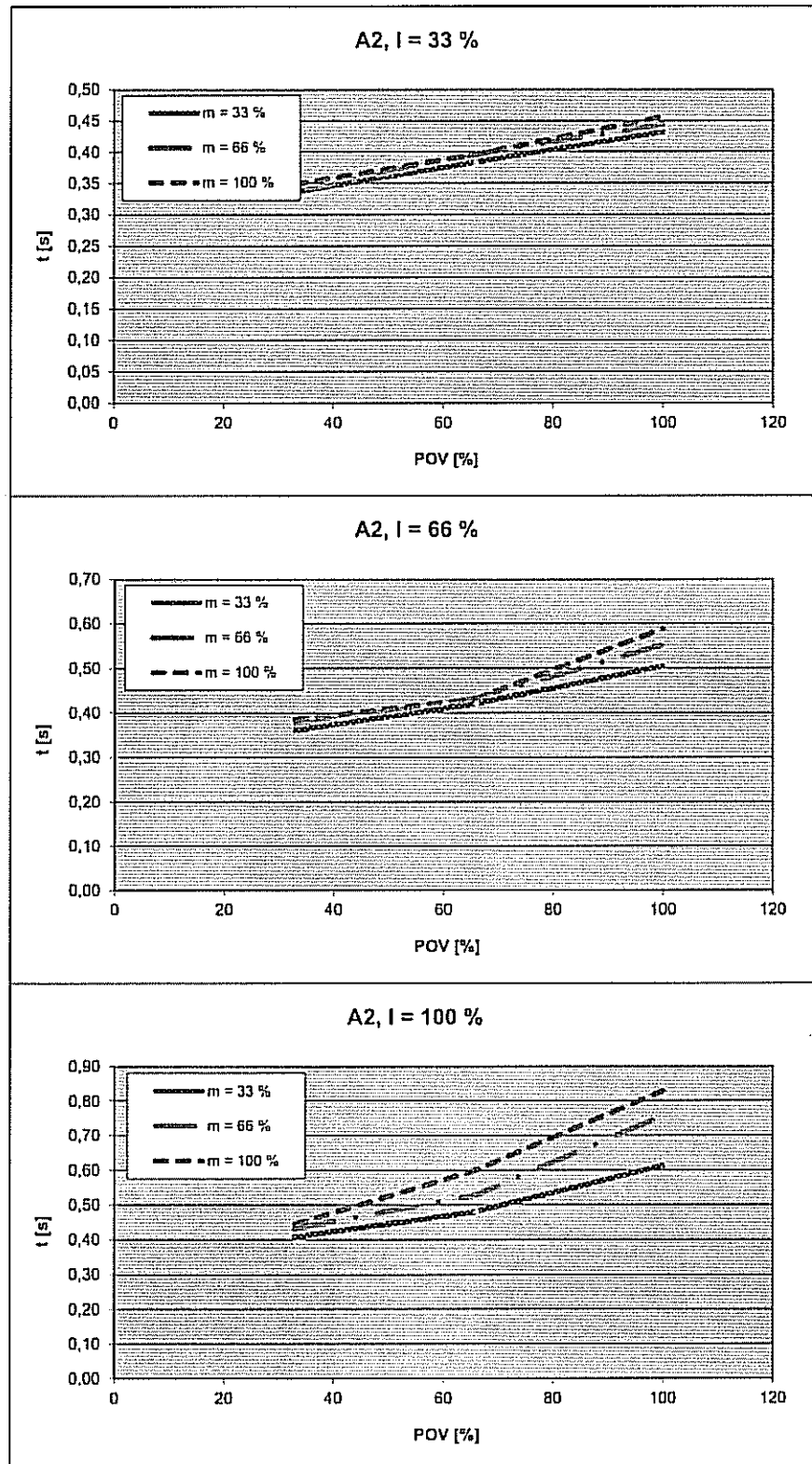


Fig. 4-34: Stopping times for STOP 1, axis 2

4.7.4.4 Stopping distances and stopping times for STOP 1, axis 3

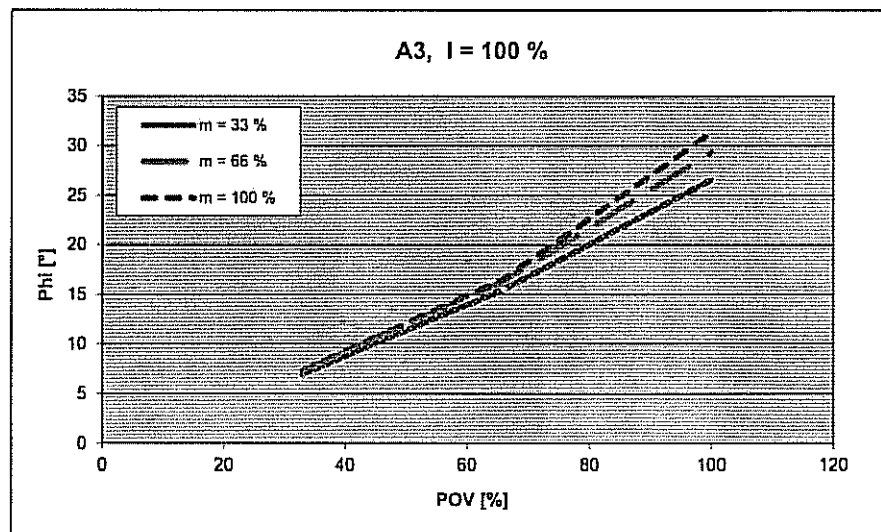


Fig. 4-35: Stopping distances for STOP 1, axis 3

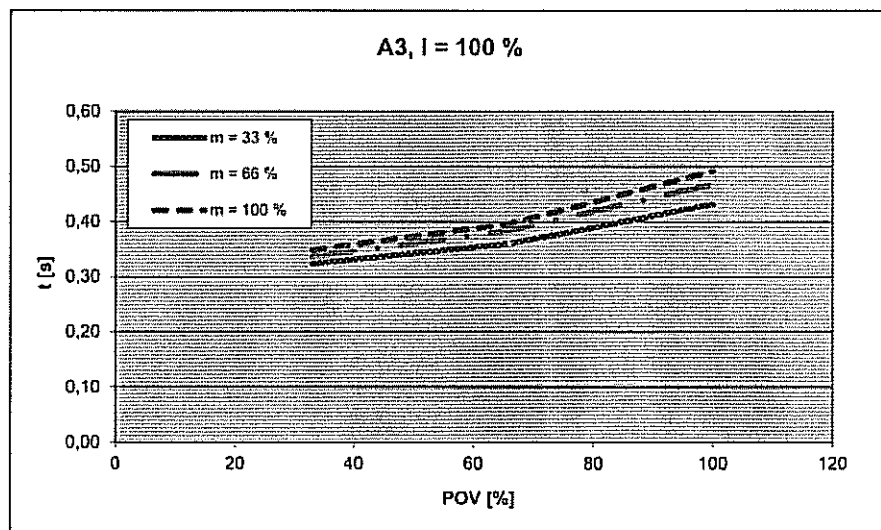


Fig. 4-36: Stopping times for STOP 1, axis 3

4.7.5 Stopping distances and times, KR 120 R3500 K prime

4.7.5.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- Extension I = 100%
- Program override POV = 100%
- Mass m = maximum load (rated load + supplementary load on arm)

	Stopping distance (°)	Stopping time (s)
Axis 1	64.08	1.116
Axis 2	60.69	1.034
Axis 3	46.01	0.599

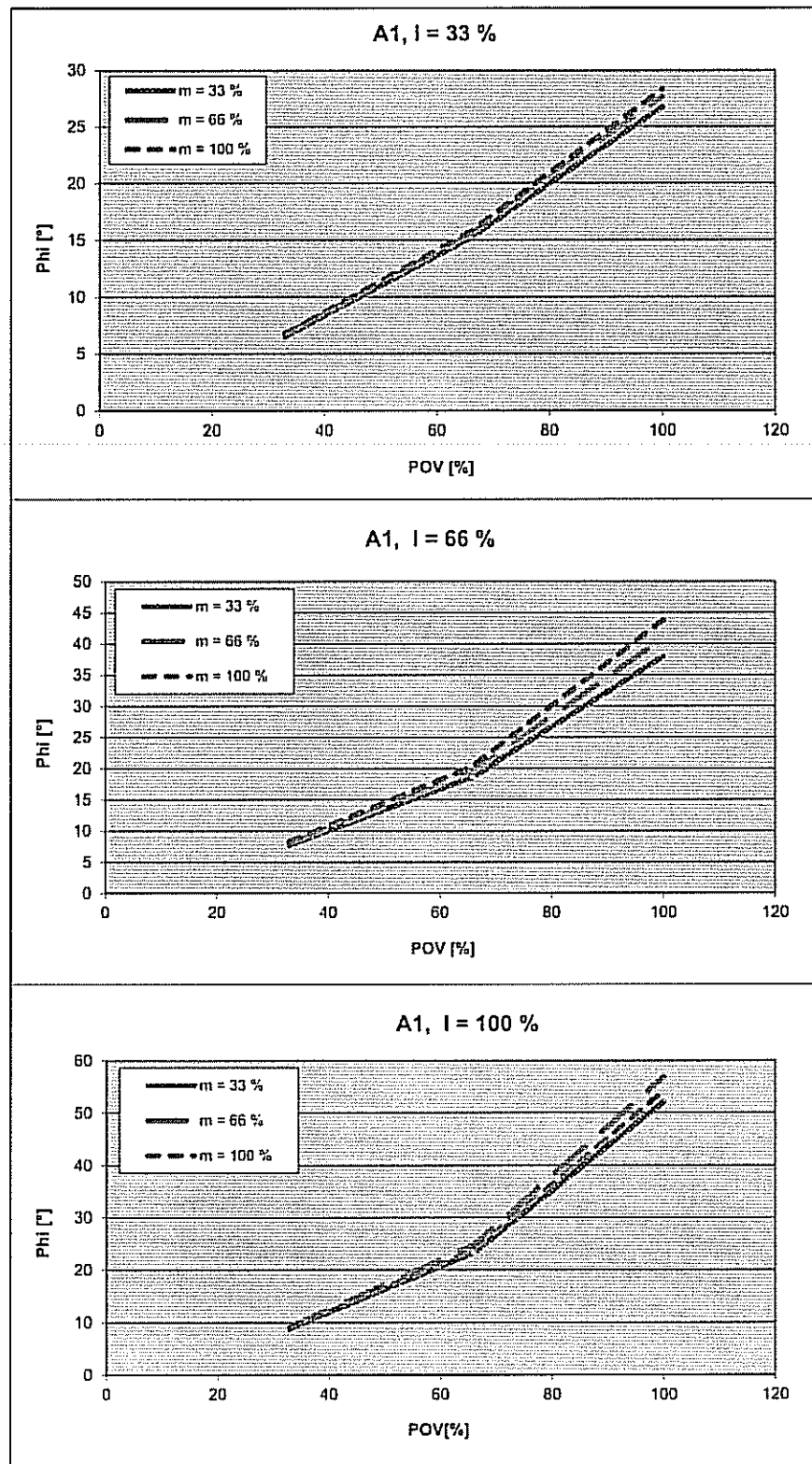


Fig. 4-37: Stopping distances for STOP 1, axis 1

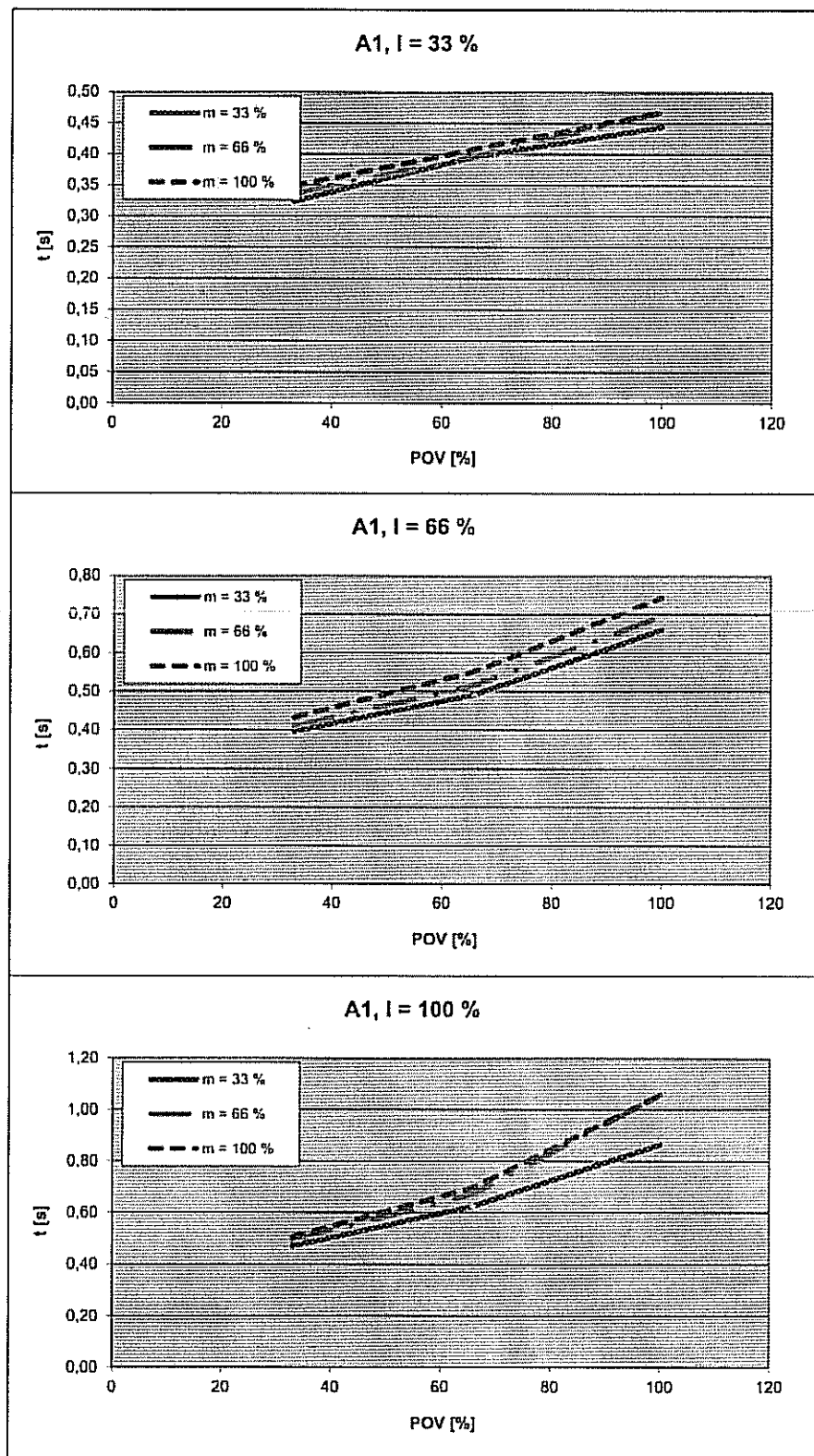


Fig. 4-38: Stopping times for STOP 1, axis 1

4.7.5.3 Stopping distances and stopping times for STOP 1, axis 2

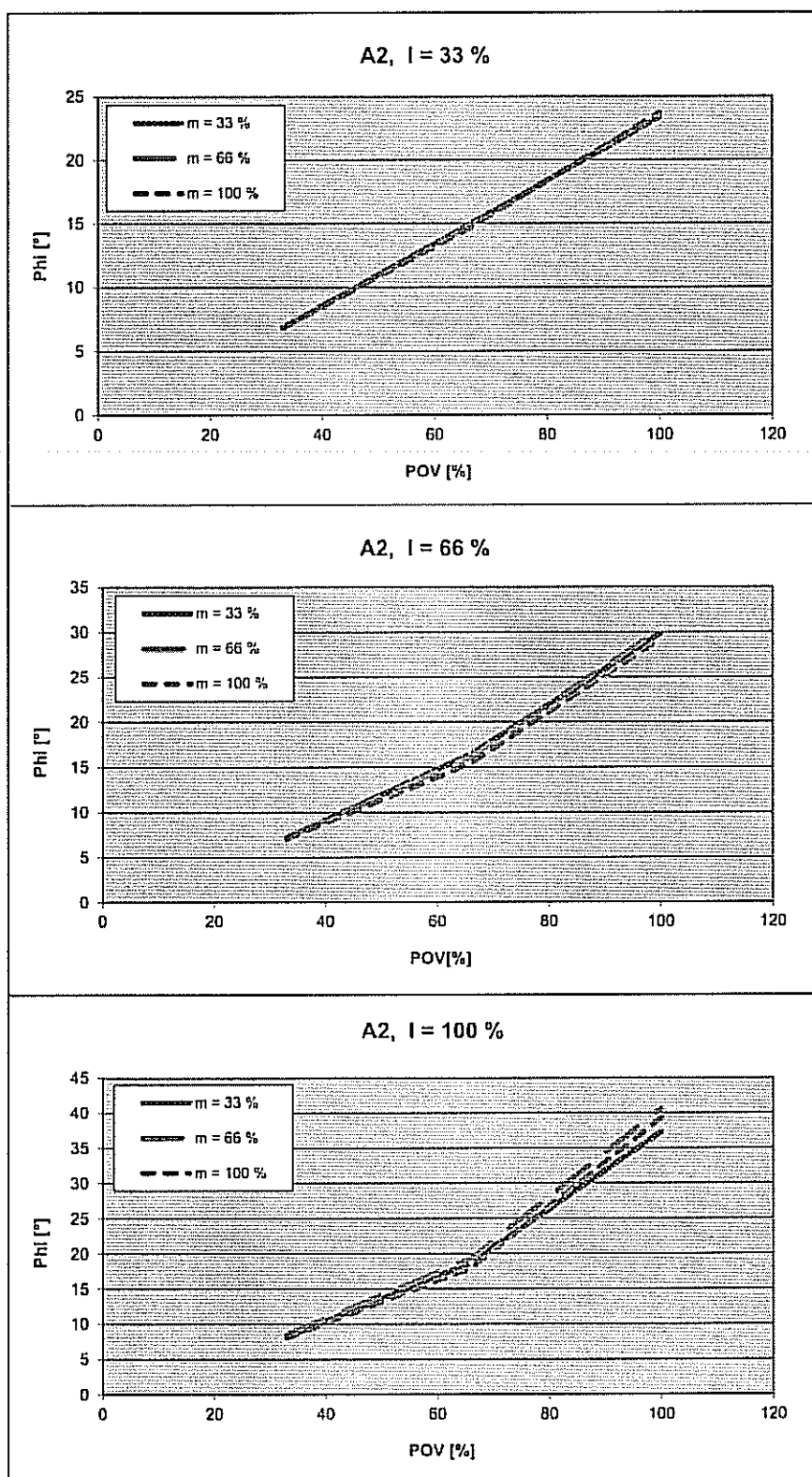


Fig. 4-39: Stopping distances for STOP 1, axis 2

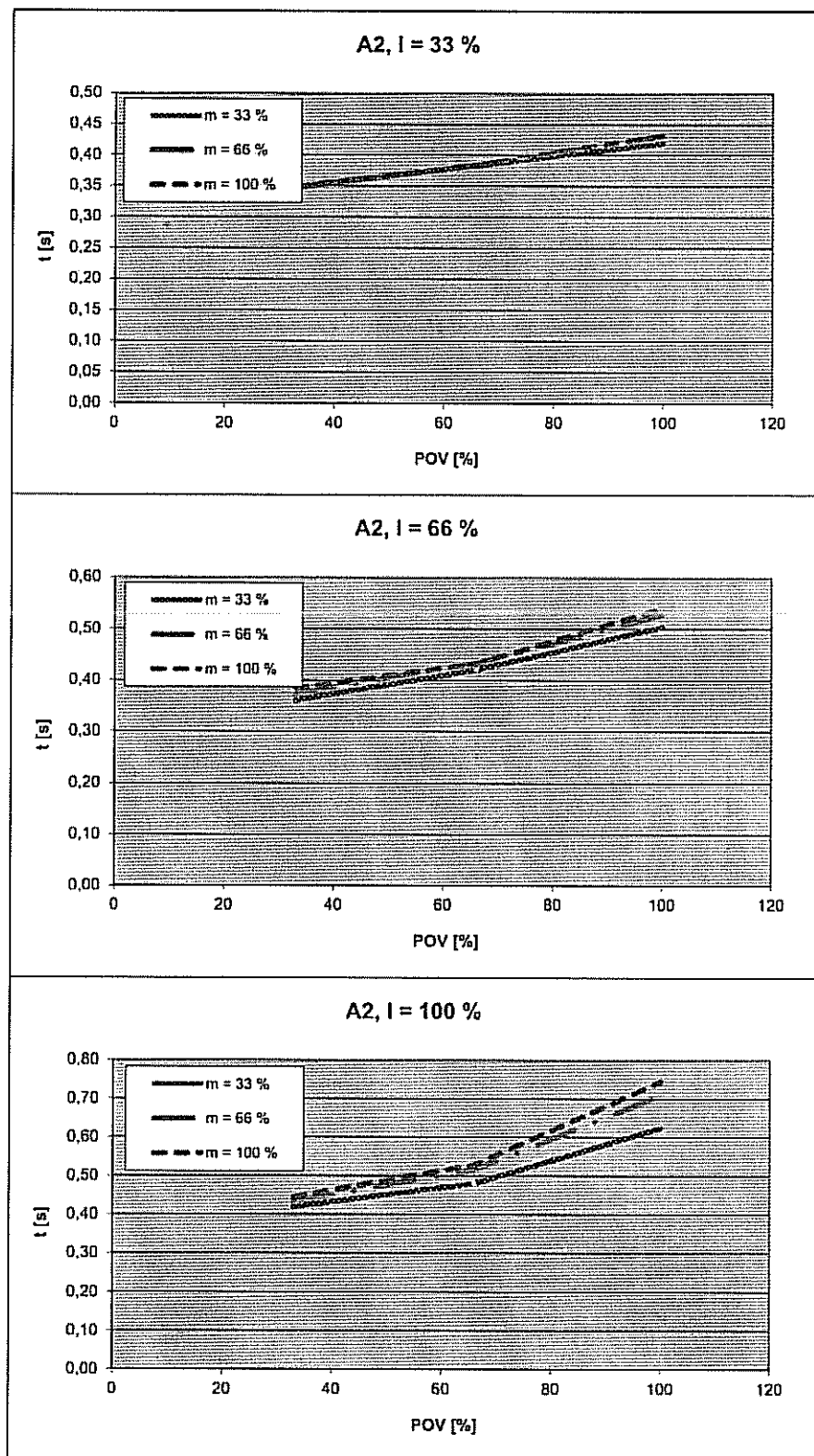


Fig. 4-40: Stopping times for STOP 1, axis 2

4.7.5.4 Stopping distances and stopping times for STOP 1, axis 3

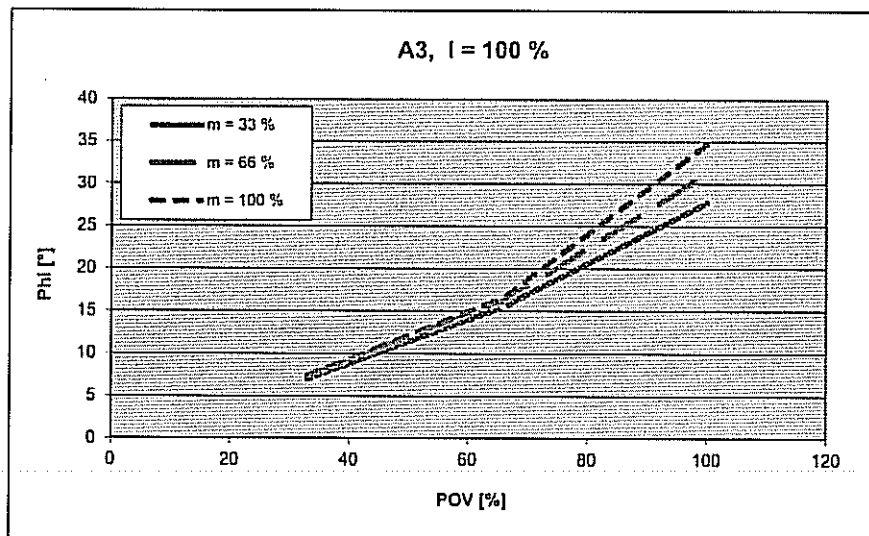


Fig. 4-41: Stopping distances for STOP 1, axis 3

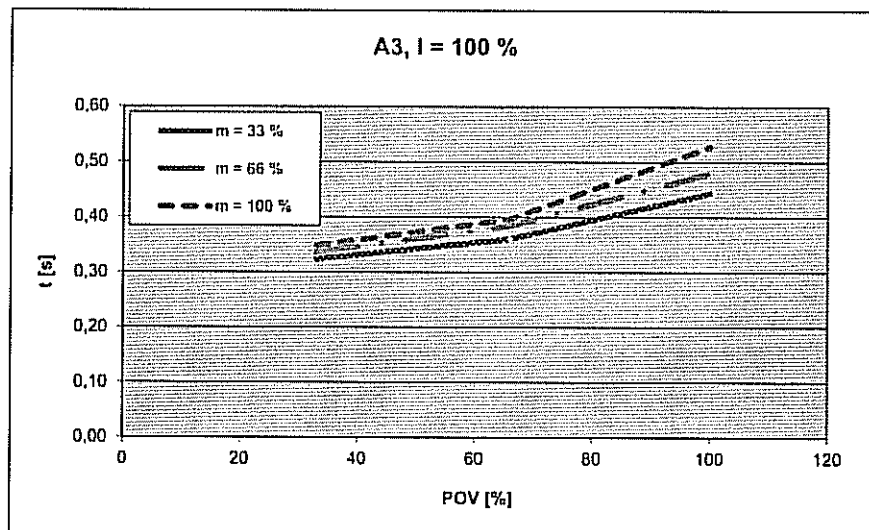


Fig. 4-42: Stopping times for STOP 1, axis 3

4.7.6 Stopping distances and times, KR 90 R3700 K prime

4.7.6.1 Stopping distances and stopping times for STOP 0, axis 1 to axis 3

The table shows the stopping distances and stopping times after a STOP 0 (category 0 stop) is triggered. The values refer to the following configuration:

- ▣ Extension $l = 100\%$
- ▣ Program override $POV = 100\%$
- ▣ Mass $m = \text{maximum load (rated load + supplementary load on arm)}$

	Stopping distance (°)	Stopping time (s)
Axis 1	62.37	1.07
Axis 2	63.23	1.033
Axis 3	46.46	0.597

4.7.6.2 Stopping distances and stopping times for STOP 1, axis 1

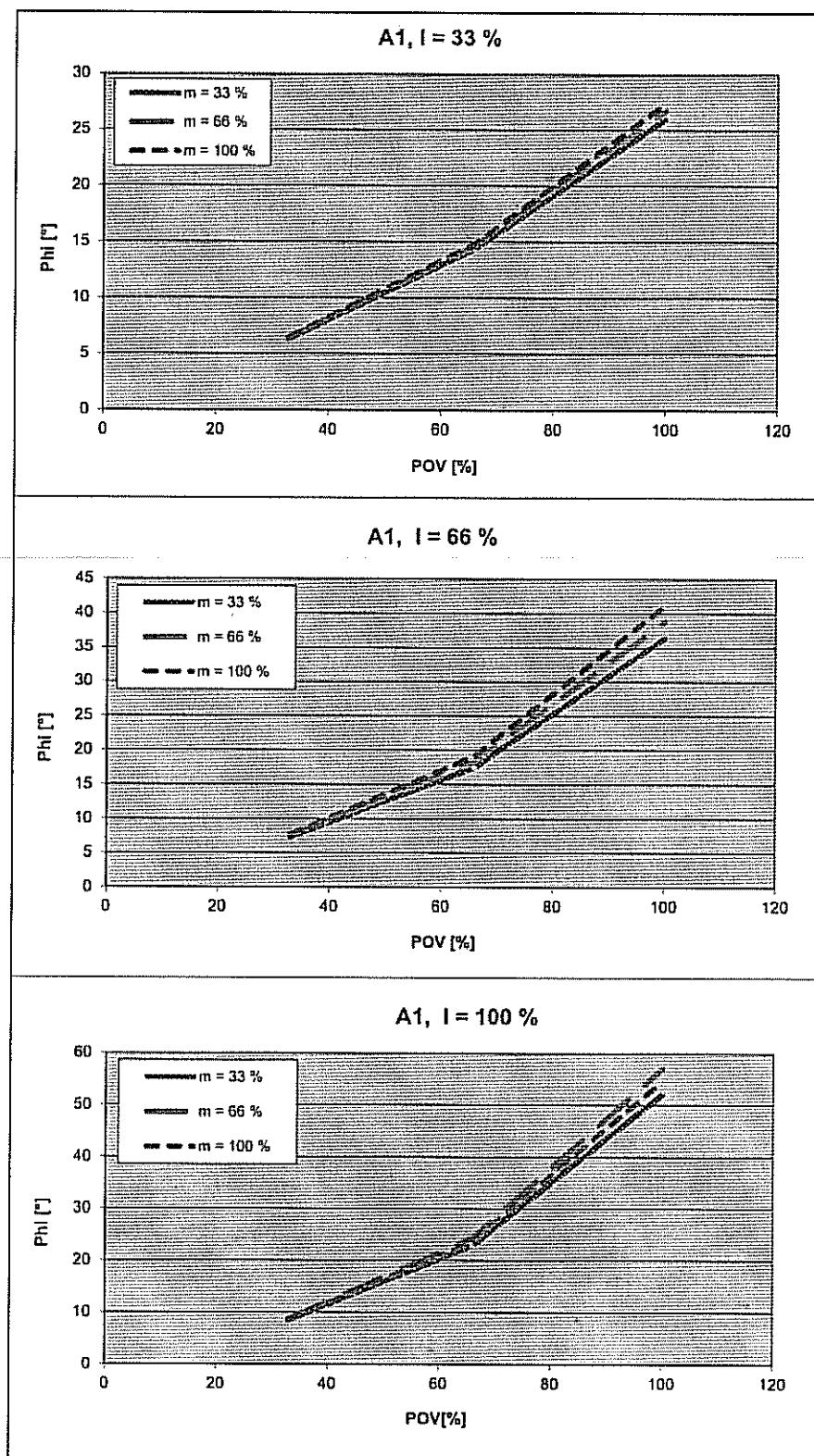


Fig. 4-43: Stopping distances for STOP 1, axis 1

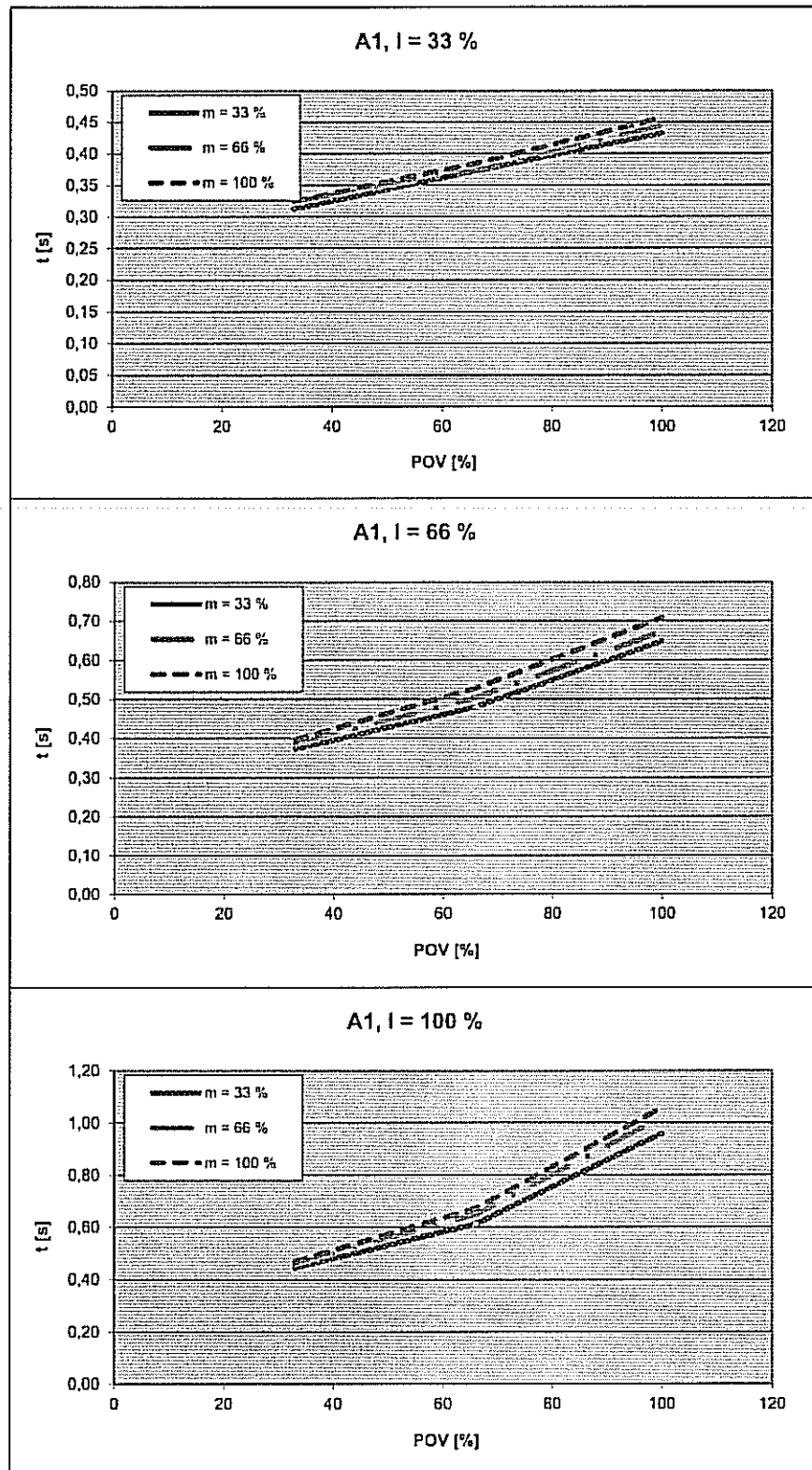


Fig. 4-44: Stopping times for STOP 1, axis 1

4.7.6.3 Stopping distances and stopping times for STOP 1, axis 2

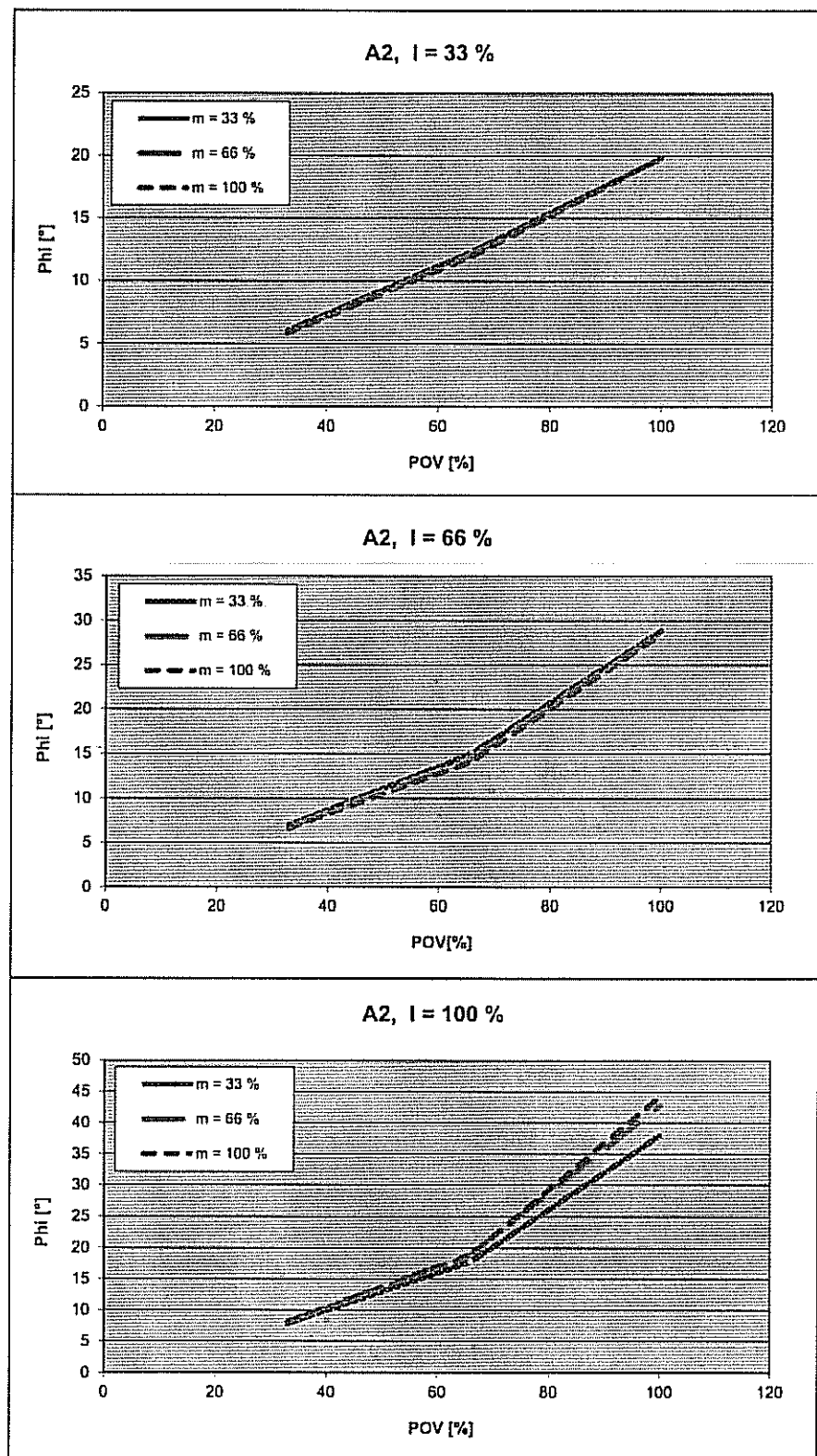


Fig. 4-45: Stopping distances for STOP 1, axis 2

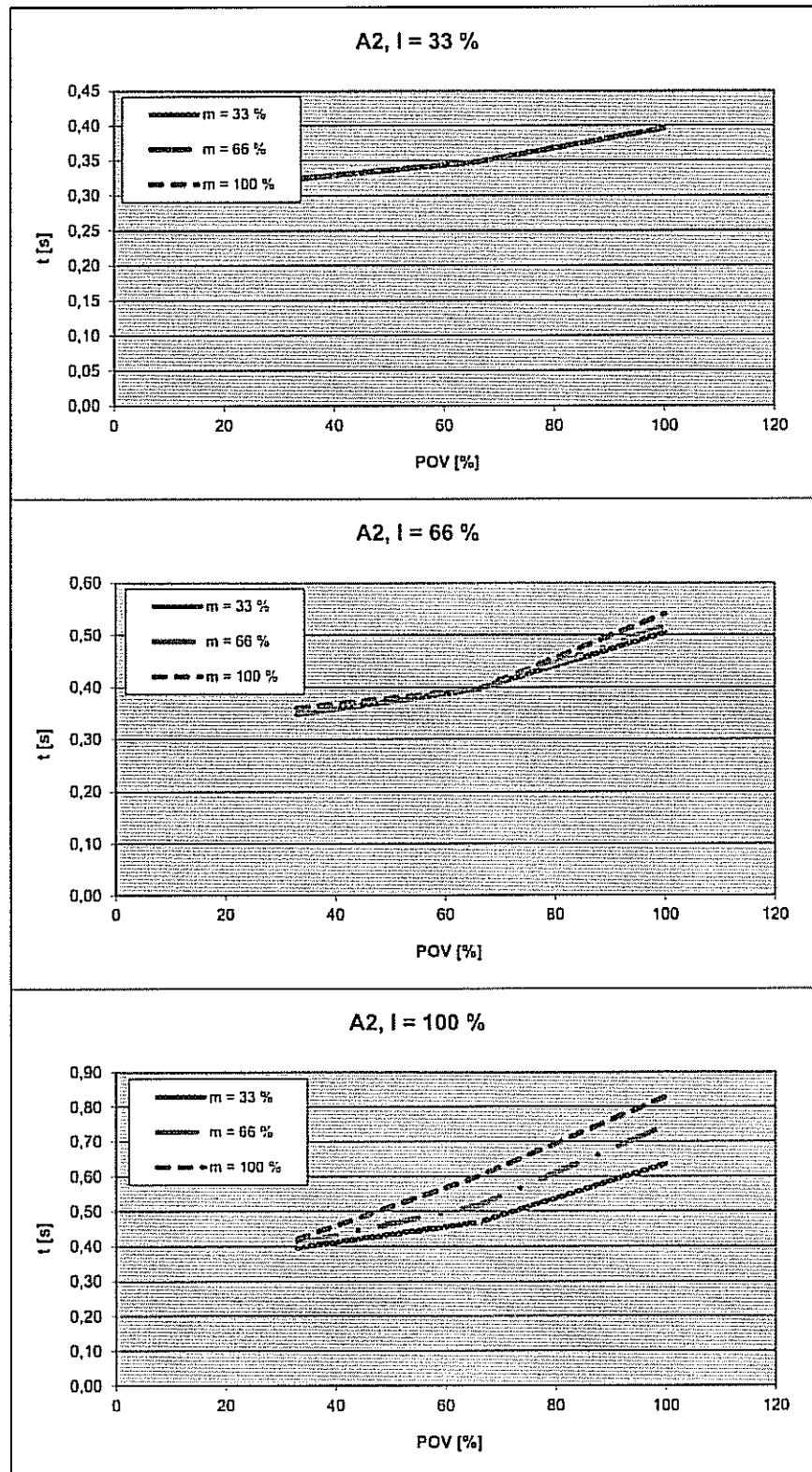


Fig. 4-46: Stopping times for STOP 1, axis 2

4.7.6.4 Stopping distances and stopping times for STOP 1, axis 3

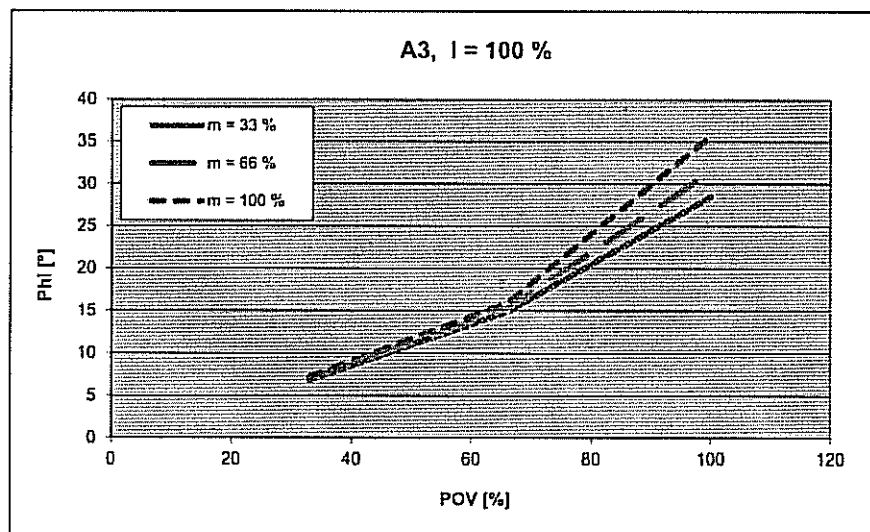


Fig. 4-47: Stopping distances for STOP 1, axis 3

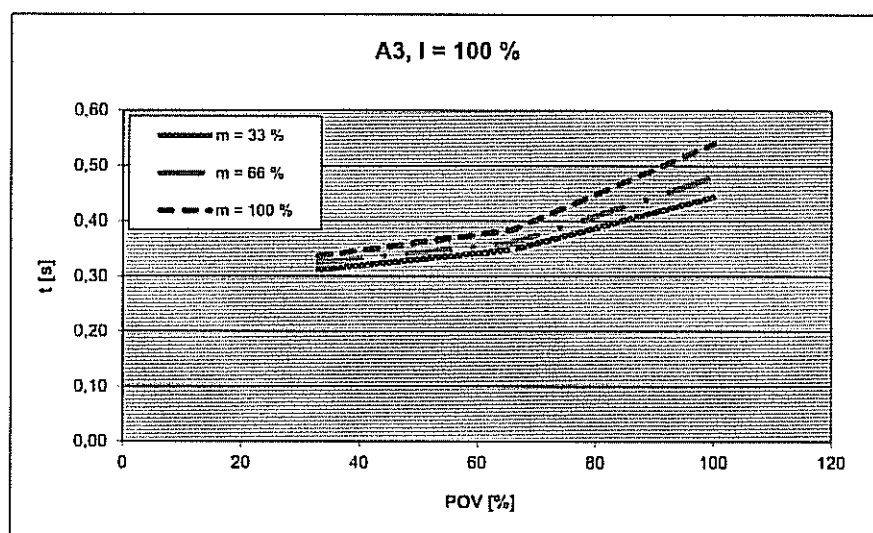


Fig. 4-48: Stopping times for STOP 1, axis 3

5 Safety

5.1 General



■ This "Safety" chapter refers to a mechanical component of an industrial robot.

■ If the mechanical component is used together with a KUKA robot controller, the "Safety" chapter of the operating instructions or assembly instructions of the robot controller must be used!

This contains all the information provided in this "Safety" chapter. It also contains additional safety information relating to the robot controller which must be observed.

■ Where this "Safety" chapter uses the term "industrial robot", this also refers to the individual mechanical component if applicable.

5.1.1 Liability

The device described in this document is either an industrial robot or a component thereof.

Components of the industrial robot:

- Manipulator
- Robot controller
- Teach pendant
- Connecting cables
- External axes (optional)
e.g. linear unit, turn-tilt table, positioner
- Software
- Options, accessories

The industrial robot is built using state-of-the-art technology and in accordance with the recognized safety rules. Nevertheless, misuse of the industrial robot may constitute a risk to life and limb or cause damage to the industrial robot and to other material property.

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons who are fully aware of the risks involved in its operation. Use of the industrial robot is subject to compliance with this document and with the declaration of incorporation supplied together with the industrial robot. Any functional disorders affecting the safety of the industrial robot must be rectified immediately.

Safety information

Safety information cannot be held against KUKA Roboter GmbH. Even if all safety instructions are followed, this is not a guarantee that the industrial robot will not cause personal injuries or material damage.

No modifications may be carried out to the industrial robot without the authorization of KUKA Roboter GmbH. Additional components (tools, software, etc.), not supplied by KUKA Roboter GmbH, may be integrated into the industrial robot. The user is liable for any damage these components may cause to the industrial robot or to other material property.

In addition to the Safety chapter, this document contains further safety instructions. These must also be observed.

5.1.2 Intended use of the industrial robot

The industrial robot is intended exclusively for the use designated in the "Purpose" chapter of the operating instructions or assembly instructions.



Further information is contained in the "Purpose" chapter of the operating instructions or assembly instructions of the industrial robot.

Using the industrial robot for any other or additional purpose is considered impermissible misuse. The manufacturer cannot be held liable for any damage resulting from such use. The risk lies entirely with the user.

Operating the industrial robot and its options within the limits of its intended use also involves observance of the operating and assembly instructions for the individual components, with particular reference to the maintenance specifications.

Misuse

Any use or application deviating from the intended use is deemed to be impermissible misuse. This includes e.g.:

- ≡ Transportation of persons and animals
- ≡ Use as a climbing aid
- ≡ Operation outside the permissible operating parameters
- ≡ Use in potentially explosive environments
- ≡ Operation without additional safeguards
- ≡ Outdoor operation
- ≡ Underground operation

5.1.3 EC declaration of conformity and declaration of incorporation

This industrial robot constitutes partly completed machinery as defined by the EC Machinery Directive. The industrial robot may only be put into operation if the following preconditions are met:

- ≡ The industrial robot is integrated into a complete system.
Or: The industrial robot, together with other machinery, constitutes a complete system.
Or: All safety functions and safeguards required for operation in the complete machine as defined by the EC Machinery Directive have been added to the industrial robot.
- ≡ The complete system complies with the EC Machinery Directive. This has been confirmed by means of an assessment of conformity.

Declaration of conformity

The system integrator must issue a declaration of conformity for the complete system in accordance with the Machinery Directive. The declaration of conformity forms the basis for the CE mark for the system. The industrial robot must be operated in accordance with the applicable national laws, regulations and standards.

The robot controller is CE certified under the EMC Directive and the Low Voltage Directive.

Declaration of incorporation

The industrial robot as partly completed machinery is supplied with a declaration of incorporation in accordance with Annex II B of the EC Machinery Directive 2006/42/EC. The assembly instructions and a list of essential requirements complied with in accordance with Annex I are integral parts of this declaration of incorporation.

The declaration of incorporation declares that the start-up of the partly completed machinery remains impermissible until the partly completed machinery

has been incorporated into machinery, or has been assembled with other parts to form machinery, and this machinery complies with the terms of the EC Machinery Directive, and the EC declaration of conformity is present in accordance with Annex II A.

The declaration of incorporation, together with its annexes, remains with the system integrator as an integral part of the technical documentation of the complete machinery.

5.1.4 Terms used

Term	Description
Axis range	Range of each axis, in degrees or millimeters, within which it may move. The axis range must be defined for each axis.
Stopping distance	Stopping distance = reaction distance + braking distance The stopping distance is part of the danger zone.
Workspace	The manipulator is allowed to move within its workspace. The workspace is derived from the individual axis ranges.
Operator (User)	The user of the industrial robot can be the management, employer or delegated person responsible for use of the industrial robot.
Danger zone	The danger zone consists of the workspace and the stopping distances.
Service life	The service life of a safety-relevant component begins at the time of delivery of the component to the customer. The service life is not affected by whether the component is used in a robot controller or elsewhere or not, as safety-relevant components are also subject to ageing during storage.
KCP	The KCP (KUKA Control Panel) teach pendant has all the operator control and display functions required for operating and programming the industrial robot. The KCP variant for the KR C4 is called KUKA smartPAD. The general term "KCP", however, is generally used in this documentation.
KUKA smartPAD	See KCP
Manipulator	The robot arm and the associated electrical installations
Safety zone	The safety zone is situated outside the danger zone.
Stop category 0	The drives are deactivated immediately and the brakes are applied. The manipulator and any external axes (optional) perform path-oriented braking. Note: This stop category is called STOP 0 in this document.
Stop category 1	The manipulator and any external axes (optional) perform path-maintaining braking. The drives are deactivated after 1 s and the brakes are applied. Note: This stop category is called STOP 1 in this document.
Stop category 2	The drives are not deactivated and the brakes are not applied. The manipulator and any external axes (optional) are braked with a normal braking ramp. Note: This stop category is called STOP 2 in this document.
System integrator (plant integrator)	System integrators are people who safely integrate the industrial robot into a complete system and commission it.
T1	Test mode, Manual Reduced Velocity (≤ 250 mm/s)
T2	Test mode, Manual High Velocity (> 250 mm/s permissible)
External axis	Motion axis which is not part of the manipulator but which is controlled using the robot controller, e.g. KUKA linear unit, turn-tilt table, Posiflex.

5.2 Personnel

The following persons or groups of persons are defined for the industrial robot:

- ≡ User
- ≡ Personnel



All persons working with the industrial robot must have read and understood the industrial robot documentation, including the safety chapter.

User

The user must observe the labor laws and regulations. This includes e.g.:

- ≡ The user must comply with his monitoring obligations.
- ≡ The user must carry out instructions at defined intervals.

Personnel

Personnel must be instructed, before any work is commenced, in the type of work involved and what exactly it entails as well as any hazards which may exist. Instruction must be carried out regularly. Instruction is also required after particular incidents or technical modifications.

Personnel includes:

- ≡ System integrator
- ≡ Operators, subdivided into:
 - ≡ Start-up, maintenance and service personnel
 - ≡ Operating personnel
 - ≡ Cleaning personnel



Installation, exchange, adjustment, operation, maintenance and repair must be performed only as specified in the operating or assembly instructions for the relevant component of the industrial robot and only by personnel specially trained for this purpose.

System integrator

The industrial robot is safely integrated into a complete system by the system integrator.

The system integrator is responsible for the following tasks:

- ≡ Installing the industrial robot
- ≡ Connecting the industrial robot
- ≡ Performing risk assessment
- ≡ Implementing the required safety functions and safeguards
- ≡ Issuing the declaration of conformity
- ≡ Attaching the CE mark
- ≡ Creating the operating instructions for the complete system

Operator

The operator must meet the following preconditions:

- ≡ The operator must be trained for the work to be carried out.
- ≡ Work on the industrial robot must only be carried out by qualified personnel. These are people who, due to their specialist training, knowledge and experience, and their familiarization with the relevant standards, are able to assess the work to be carried out and detect any potential hazards.

Example

The tasks can be distributed as shown in the following table.

Tasks	Operator	Programmer	System integrator
Switch robot controller on/off	x	x	x
Start program	x	x	x
Select program	x	x	x
Select operating mode	x	x	x
Calibration (tool, base)		x	x
Master the manipulator		x	x
Configuration		x	x
Programming		x	x
Start-up			x
Maintenance			x
Repair			x
Decommissioning			x
Transportation			x



Work on the electrical and mechanical equipment of the industrial robot may only be carried out by specially trained personnel.

5.3 Workspace, safety zone and danger zone

Workspaces are to be restricted to the necessary minimum size. A workspace must be safeguarded using appropriate safeguards.

The safeguards (e.g. safety gate) must be situated inside the safety zone. In the case of a stop, the manipulator and external axes (optional) are braked and come to a stop within the danger zone.

The danger zone consists of the workspace and the stopping distances of the manipulator and external axes (optional). It must be safeguarded by means of physical safeguards to prevent danger to persons or the risk of material damage.

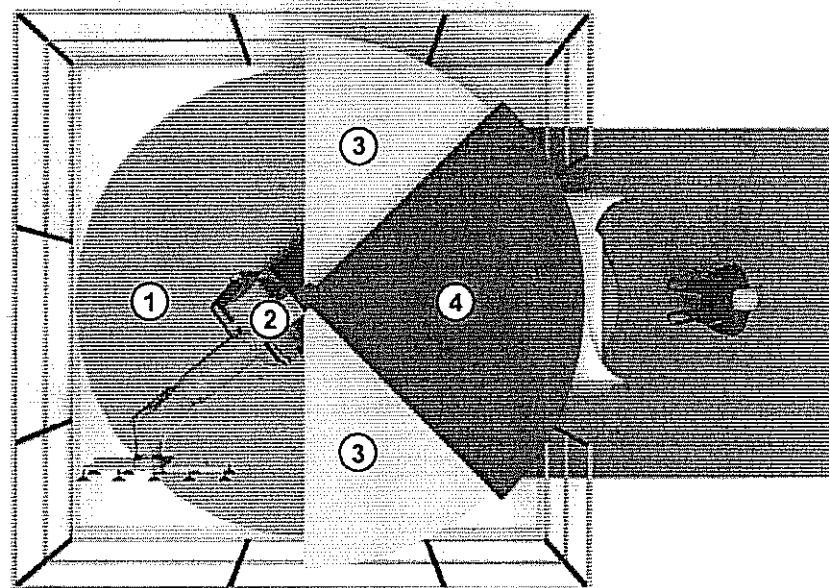


Fig. 5-1: Example of axis range A1

- | | | | |
|---|-------------|---|-------------------|
| 1 | Workspace | 3 | Stopping distance |
| 2 | Manipulator | 4 | Safety zone |

5.4 Overview of protective equipment

The protective equipment of the mechanical component may include:

- Mechanical end stops
- Mechanical axis range limitation (optional)
- Axis range monitoring (optional)
- Release device (optional)
- Labeling of danger areas

Not all equipment is relevant for every mechanical component.

5.4.1 Mechanical end stops

Depending on the robot variant, the axis ranges of the main and wrist axes of the manipulator are partially limited by mechanical end stops.

Additional mechanical end stops can be installed on the external axes.

NOTICE If the manipulator or an external axis hits an obstruction or a mechanical end stop or axis range limitation, this can result in material damage to the industrial robot. The manipulator must be taken out of operation and KUKA Roboter GmbH must be consulted before it is put back into operation (>>> 16 "KUKA Service" Page 193).

5.4.2 Mechanical axis range limitation (optional)

Some manipulators can be fitted with mechanical axis range limitation in axes A1 to A3. The adjustable axis range limitation systems restrict the working range to the required minimum. This increases personal safety and protection of the system.

In the case of manipulators that are not designed to be fitted with mechanical axis range limitation, the workspace must be laid out in such a way that there is no danger to persons or material property, even in the absence of mechanical axis range limitation.

If this is not possible, the workspace must be limited by means of photoelectric barriers, photoelectric curtains or obstacles on the system side. There must be no shearing or crushing hazards at the loading and transfer areas.



This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.4.3 Axis range monitoring (optional)

Some manipulators can be fitted with dual-channel axis range monitoring systems in main axes A1 to A3. The positioner axes may be fitted with additional axis range monitoring systems. The safety zone for an axis can be adjusted and monitored using an axis range monitoring system. This increases personal safety and protection of the system.



This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.4.4 Devices for moving the manipulator without the robot controller (options)

Description

The following devices are available for moving the manipulator after an accident or malfunction:

■ Release device

The release device can be used for the main axis drive motors and, depending on the robot variant, also for the wrist axis drive motors.

■ Brake release device

The brake release device is designed for robot variants whose motors are not freely accessible.

The devices are only for use in exceptional circumstances and emergencies, e.g. for freeing people.



These options are not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.



CAUTION The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

Procedure

Moving the manipulator with the release device:

1. Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
2. Remove the protective cap from the motor.
3. Push the release device onto the corresponding motor and move the axis in the desired direction.

The directions are indicated with arrows on the motors. It is necessary to overcome the resistance of the mechanical motor brake and any other loads acting on the axis.



WARNING Moving an axis with the release device can damage the motor brake. This can result in personal injury and material damage. After using the release device, the motor must be exchanged.



WARNING If a robot axis has been moved by the release device, all robot axes must be remastered. Serious injuries or damage to property may otherwise result.

Procedure

Moving the manipulator with the brake release device:



WARNING Use of the brake release device may result in unexpected robot motions, especially sagging of the axes. During use of the brake release device, attention must be paid to motion of this kind in order to be able to prevent physical injuries or damage to property. Standing under moving axes is not permitted.

1. Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
2. Connect the brake release device to the base frame of the robot:
Unplug connector X30 from interface A1. Plug connector X20 of the brake release device into interface A1.
3. Select the brakes to be released (main axes, wrist axes) via the selection switch on the brake release device.
4. Press the button on the hand-held device.
The brakes of the main axes or wrist axes are released and the robot can be moved manually.



Further information about the brake release device can be found in the documentation for the brake release device.

5.4.5 Labeling on the industrial robot

All plates, labels, symbols and marks constitute safety-relevant parts of the industrial robot. They must not be modified or removed.

Labeling on the industrial robot consists of:

- ≡ Identification plates
- ≡ Warning labels
- ≡ Safety symbols
- ≡ Designation labels
- ≡ Cable markings
- ≡ Rating plates



Further information is contained in the technical data of the operating instructions or assembly instructions of the components of the industrial robot.

5.5 Safety measures

5.5.1 General safety measures

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons. Operator errors can result in personal injury and damage to property.

It is important to be prepared for possible movements of the industrial robot even after the robot controller has been switched off and locked. Incorrect installation (e.g. overload) or mechanical defects (e.g. brake defect) can cause the manipulator or external axes to sag. If work is to be carried out on a switched-off industrial robot, the manipulator and external axes must first be moved into a position in which they are unable to move on their own, whether the payload is mounted or not. If this is not possible, the manipulator and external axes must be secured by appropriate means.

⚠ DANGER In the absence of operational safety functions and safeguards, the industrial robot can cause personal injury or material damage. If safety functions or safeguards are dismantled or deactivated, the industrial robot may not be operated.

⚠ WARNING Standing underneath the robot arm can cause death or serious injuries. For this reason, standing underneath the robot arm is prohibited!

⚠ CAUTION The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

KCP

The user must ensure that the industrial robot is only operated with the KCP by authorized persons.

If more than one KCP is used in the overall system, it must be ensured that each KCP is unambiguously assigned to the corresponding industrial robot. They must not be interchanged.

⚠ WARNING The operator must ensure that decoupled KCPs are immediately removed from the system and stored out of sight and reach of personnel working on the industrial robot. This serves to prevent operational and non-operational EMERGENCY STOP devices from becoming interchanged. Failure to observe this precaution may result in death, severe injuries or considerable damage to property.

External keyboard, external mouse

An external keyboard and/or external mouse may only be used if the following conditions are met:

- ▣ Start-up or maintenance work is being carried out.
- ▣ The drives are switched off.
- ▣ There are no persons in the danger zone.

The KCP must not be used as long as an external keyboard and/or external mouse are connected.

The external keyboard and/or external mouse must be removed as soon as the start-up or maintenance work is completed or the KCP is connected.

Faults

The following tasks must be carried out in the case of faults in the industrial robot:

- ▣ Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
- ▣ Indicate the fault by means of a label with a corresponding warning (tag-out).
- ▣ Keep a record of the faults.
- ▣ Eliminate the fault and carry out a function test.

Modifications

After modifications to the industrial robot, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).

After modifications to the industrial robot, existing programs must always be tested first in Manual Reduced Velocity mode (T1). This applies to all components of the industrial robot and includes modifications to the software and configuration settings.

5.5.2 Transportation**Manipulator**

The prescribed transport position of the manipulator must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the robot.

Robot controller

The prescribed transport position of the robot controller must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the robot controller.

Avoid vibrations and impacts during transportation in order to prevent damage to the robot controller.

**External axis
(optional)**

The prescribed transport position of the external axis (e.g. KUKA linear unit, turn-tilt table, positioner) must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the external axis.

5.5.3 Start-up and recommissioning

Before starting up systems and devices for the first time, a check must be carried out to ensure that the systems and devices are complete and operational, that they can be operated safely and that any damage is detected.

The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.



The passwords for logging onto the KUKA System Software as "Expert" and "Administrator" must be changed before start-up and must only be communicated to authorized personnel.



The robot controller is preconfigured for the specific industrial robot. If cables are interchanged, the manipulator and the external axes (optional) may receive incorrect data and can thus cause personal injury or material damage. If a system consists of more than one manipulator, always connect the connecting cables to the manipulators and their corresponding robot controllers.



If additional components (e.g. cables), which are not part of the scope of supply of KUKA Roboter GmbH, are integrated into the industrial robot, the user is responsible for ensuring that these components do not adversely affect or disable safety functions.

NOTICE

If the internal cabinet temperature of the robot controller differs greatly from the ambient temperature, condensation can form, which may cause damage to the electrical components. Do not put the robot controller into operation until the internal temperature of the cabinet has adjusted to the ambient temperature.

Function test

The following tests must be carried out before start-up and recommissioning:

It must be ensured that:

- ▣ The industrial robot is correctly installed and fastened in accordance with the specifications in the documentation.
- ▣ There are no foreign bodies or loose parts on the industrial robot.
- ▣ All required safety equipment is correctly installed and operational.
- ▣ The power supply ratings of the industrial robot correspond to the local supply voltage and mains type.
- ▣ The ground conductor and the equipotential bonding cable are sufficiently rated and correctly connected.
- ▣ The connecting cables are correctly connected and the connectors are locked.

Machine data

It must be ensured that the rating plate on the robot controller has the same machine data as those entered in the declaration of incorporation. The machine data on the rating plate of the manipulator and the external axes (optional) must be entered during start-up.

DANGER

The industrial robot must not be moved if incorrect machine data are loaded. Death, severe injuries or considerable damage to property may otherwise result. The correct machine data must be loaded.

5.5.4 Manual mode

Manual mode is the mode for setup work. Setup work is all the tasks that have to be carried out on the industrial robot to enable automatic operation. Setup work includes:

- ▣ Jog mode
- ▣ Teach
- ▣ Programming
- ▣ Program verification

The following must be taken into consideration in manual mode:

- ▣ If the drives are not required, they must be switched off to prevent the manipulator or the external axes (optional) from being moved unintentionally. New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).
- ▣ The manipulator, tooling or external axes (optional) must never touch or project beyond the safety fence.
- ▣ Workpieces, tooling and other objects must not become jammed as a result of the industrial robot motion, nor must they lead to short-circuits or be liable to fall off.
- ▣ All setup work must be carried out, where possible, from outside the safeguarded area.

If the setup work has to be carried out inside the safeguarded area, the following must be taken into consideration:

In Manual Reduced Velocity mode (T1):

- ≡ If it can be avoided, there must be no other persons inside the safeguarded area.

If it is necessary for there to be several persons inside the safeguarded area, the following must be observed:

- ≡ Each person must have an enabling device.
- ≡ All persons must have an unimpeded view of the industrial robot.
- ≡ Eye-contact between all persons must be possible at all times.
- ≡ The operator must be so positioned that he can see into the danger area and get out of harm's way.

In Manual High Velocity mode (T2):

- ≡ This mode may only be used if the application requires a test at a velocity higher than Manual Reduced Velocity.
- ≡ Teaching and programming are not permissible in this operating mode.
- ≡ Before commencing the test, the operator must ensure that the enabling devices are operational.
- ≡ The operator must be positioned outside the danger zone.
- ≡ There must be no other persons inside the safeguarded area. It is the responsibility of the operator to ensure this.

5.5.5 Automatic mode

Automatic mode is only permissible in compliance with the following safety measures:

- ≡ All safety equipment and safeguards are present and operational.
- ≡ There are no persons in the system.
- ≡ The defined working procedures are adhered to.

If the manipulator or an external axis (optional) comes to a standstill for no apparent reason, the danger zone must not be entered until an EMERGENCY STOP has been triggered.

5.5.6 Maintenance and repair

After maintenance and repair work, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

The purpose of maintenance and repair work is to ensure that the system is kept operational or, in the event of a fault, to return the system to an operational state. Repair work includes troubleshooting in addition to the actual repair itself.

The following safety measures must be carried out when working on the industrial robot:

- ≡ Carry out work outside the danger zone. If work inside the danger zone is necessary, the user must define additional safety measures to ensure the safe protection of personnel.
- ≡ Switch off the industrial robot and secure it (e.g. with a padlock) to prevent it from being switched on again. If it is necessary to carry out work with the robot controller switched on, the user must define additional safety measures to ensure the safe protection of personnel.
- ≡ If it is necessary to carry out work with the robot controller switched on, this may only be done in operating mode T1.

- Label the system with a sign indicating that work is in progress. This sign must remain in place, even during temporary interruptions to the work.
- The EMERGENCY STOP systems must remain active. If safety functions or safeguards are deactivated during maintenance or repair work, they must be reactivated immediately after the work is completed.

⚠ WARNING Before work is commenced on live parts of the robot system, the main switch must be turned off and secured against being switched on again by unauthorized personnel. The incoming power cable must be deenergized. The robot controller and mains supply lead must then be checked to ensure that it is deenergized. If the KR C4 or VKR C4 robot controller is used: It is not sufficient, before commencing work on live parts, to execute an EMERGENCY STOP or a safety stop, or to switch off the drives, as this does not disconnect the robot system from the mains power supply in the case of the drives of the new generation. Parts remain energized. Death or severe injuries may result.

Faulty components must be replaced using new components with the same article numbers or equivalent components approved by KUKA Roboter GmbH for this purpose.

Cleaning and preventive maintenance work is to be carried out in accordance with the operating instructions.

Robot controller

Even when the robot controller is switched off, parts connected to peripheral devices may still carry voltage. The external power sources must therefore be switched off if work is to be carried out on the robot controller.

The ESD regulations must be adhered to when working on components in the robot controller.

Voltages in excess of 50 V (up to 600 V) can be present in various components for several minutes after the robot controller has been switched off! To prevent life-threatening injuries, no work may be carried out on the industrial robot in this time.

Water and dust must be prevented from entering the robot controller.

Counterbalancing system

Some robot variants are equipped with a hydropneumatic, spring or gas cylinder counterbalancing system.

The hydropneumatic and gas cylinder counterbalancing systems are pressure equipment and, as such, are subject to obligatory equipment monitoring. Depending on the robot variant, the counterbalancing systems correspond to category 0, II or III, fluid group 2, of the Pressure Equipment Directive.

The user must comply with the applicable national laws, regulations and standards pertaining to pressure equipment.

Inspection intervals in Germany in accordance with Industrial Safety Order, Sections 14 and 15. Inspection by the user before commissioning at the installation site.

The following safety measures must be carried out when working on the counterbalancing system:

- The manipulator assemblies supported by the counterbalancing systems must be secured.
- Work on the counterbalancing systems must only be carried out by qualified personnel.

Hazardous substances

The following safety measures must be carried out when handling hazardous substances:

- Avoid prolonged and repeated intensive contact with the skin.

- Avoid breathing in oil spray or vapors.
- Clean skin and apply skin cream.



To ensure safe use of our products, we recommend that our customers regularly request up-to-date safety data sheets from the manufacturers of hazardous substances.

5.5.7 Decommissioning, storage and disposal

The industrial robot must be decommissioned, stored and disposed of in accordance with the applicable national laws, regulations and standards.

5.6 Applied norms and regulations

Name	Definition	Edition
2006/42/EC	Machinery Directive: Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)	2006
2004/108/EC	EMC Directive: Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	2004
97/23/EC	Pressure Equipment Directive: Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment (Only applicable for robots with hydropneumatic counterbalancing system.)	1997
EN ISO 13850	Safety of machinery: Emergency stop - Principles for design	2008
EN ISO 13849-1	Safety of machinery: Safety-related parts of control systems - Part 1: General principles of design	2008
EN ISO 13849-2	Safety of machinery: Safety-related parts of control systems - Part 2: Validation	2008
EN ISO 12100	Safety of machinery: General principles of design, risk assessment and risk reduction	2010
EN ISO 10218-1	Industrial robots: Safety	2011
EN 614-1	Safety of machinery: Ergonomic design principles - Part 1: Terms and general principles	2006
EN 61000-6-2	Electromagnetic compatibility (EMC): Part 6-2: Generic standards; Immunity for industrial environments	2005

Name	Definition	Edition
EN 61000-6-4	Electromagnetic compatibility (EMC): Part 6-4: Generic standards; Emission standard for industrial environments	2007
EN 60204-1	Safety of machinery: Electrical equipment of machines - Part 1: General requirements	2006

6 Planning

6.1 Mounting base with centering

Description The mounting base with centering is used when the robot is fastened to the floor, i.e. directly on a concrete foundation.

The mounting base with centering consists of:

- Bedplates
- Resin-bonded anchors (chemical anchors)
- Fastening elements

This mounting variant requires a level and smooth surface on a concrete foundation with adequate load bearing capacity. The concrete foundation must be able to accommodate the forces occurring during operation. There must be no layers of insulation or screed between the bedplates and the concrete foundation.

The minimum dimensions must be observed.

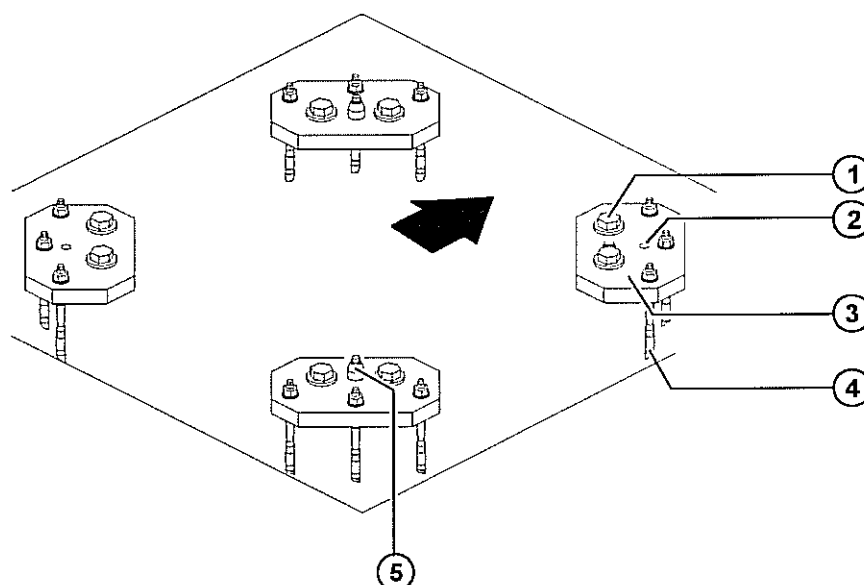


Fig. 6-1: Mounting base

- | | |
|----------------------------------|---|
| 1 Hexagon bolt | 4 Resin-bonded anchors with Dynamic Set |
| 2 M20 thread for mastering screw | 5 Pin with Allen screw |
| 3 Bedplate | |

Grade of concrete for foundations When producing foundations from concrete, observe the load-bearing capacity of the ground and the country-specific construction regulations. The concrete must have no cracks and fulfill the following norm for quality:

- C20/25 according to DIN EN 206-1:2001/DIN 1045-2:2001

Dimensioned drawing The following illustrations provide all the necessary information on the mounting base, together with the required foundation data.



Fig. 6-2: Mounting base, dimensioned drawing

- 1 Robot
- 2 Bedplate
- 3 Concrete foundation

To ensure that the anchor forces are safely transmitted to the foundation, observe the dimensions for concrete foundations specified in the following illustration.



Fig. 6-3: Cross-section of foundations

- | | | | |
|---|---------------------|---|--------------|
| 1 | Bedplate | 3 | Pin |
| 2 | Concrete foundation | 4 | Hexagon bolt |

6.2 Machine frame mounting

Description

The machine frame mounting assembly with centering is used when the robot is fastened on a steel structure, a booster frame (pedestal) or a KUKA linear unit. This assembly is also used if the manipulator is installed in an inverted position, i.e. on the ceiling. It must be ensured that the substructure is able to withstand safely the forces occurring during operation (foundation loads). The following diagram contains all the necessary information that must be observed when preparing the mounting surface (>>> Fig. 6-4).

The machine frame mounting assembly consists of:

- Pin with fasteners
- Hexagon bolts with conical spring washers

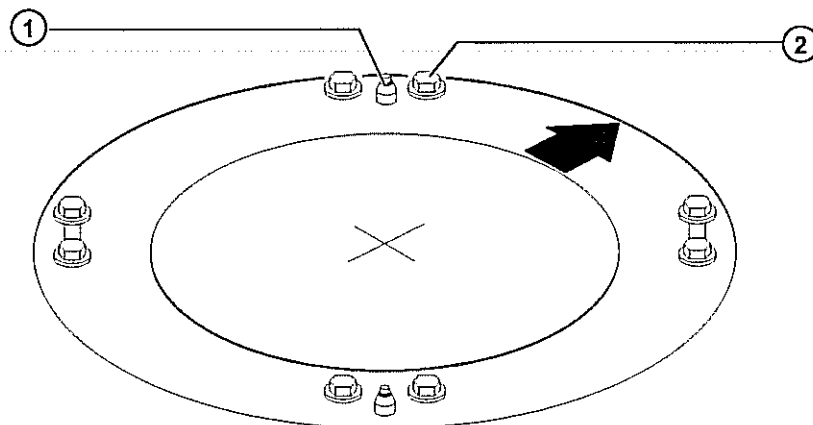


Fig. 6-4: Machine frame mounting

- 1 Pin
- 2 Hexagon bolt

Dimensioned drawing

The following illustrations provide all the necessary information on machine frame mounting, together with the required foundation data.

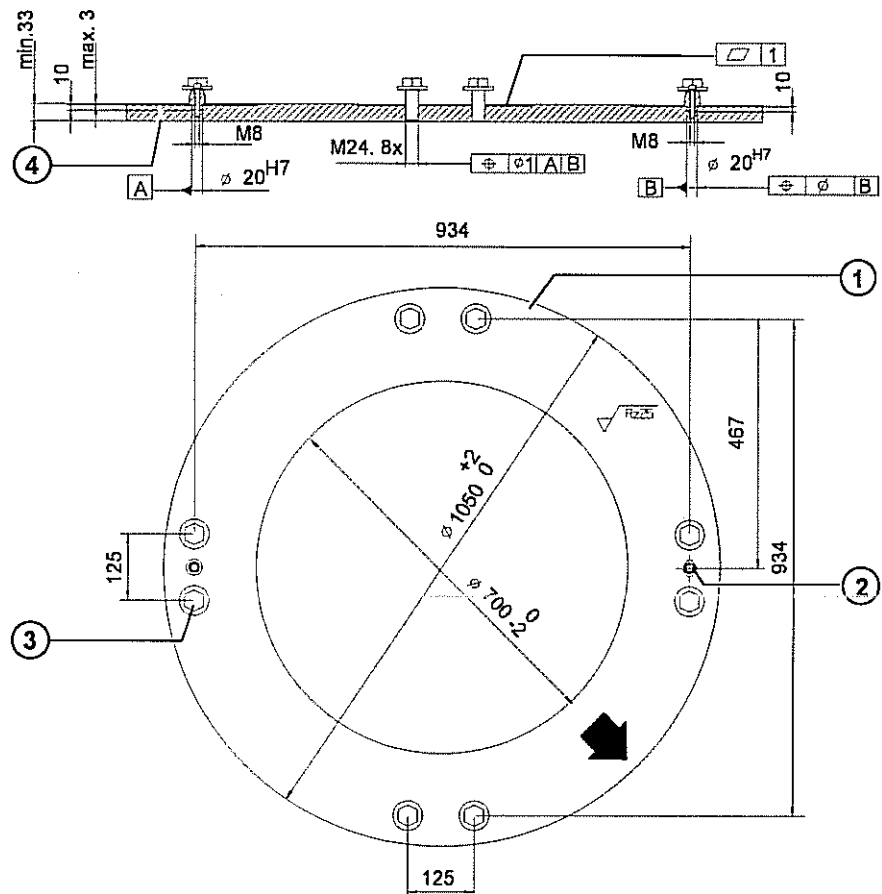


Fig. 6-5: Machine frame mounting, dimensioned drawing

- | | |
|--------------------|---------------------|
| 1 Mounting surface | 3 Hexagon bolt (8x) |
| 2 Pin | 4 Steel structure |

6.3 Connecting cables and interfaces

Connecting cables

The connecting cables comprise all the cables for transferring energy and signals between the robot and the robot controller. They are connected to the robot junction boxes with connectors. The set of connecting cables comprises:

- Motor cable, X20 - X30
- Data cable X21 - X31
- Ground conductor (order as an option)

Depending on the specification of the robot, various connecting cables are used. Cable lengths of 7 m, 15 m, 25 m, 35 m and 50 m are available. The maximum length of the connecting cables must not exceed 50 m. Thus if the robot is operated on a linear unit which has its own energy supply chain these cables must also be taken into account.



 For the connecting cables, a ground conductor is always required to provide a low-resistance connection between the robot and the control cabinet in accordance with DIN EN 60204. The ground conductor is not part of the scope of supply and can be ordered as an option. The connection must be made by the customer. The tapped holes for connecting the ground conductor are located on the base frame of the robot.

The following points must be observed when planning and routing the connecting cables:

- The bending radius for fixed routing must not be less than 150 mm for motor cables and 60 mm for control cables.
- Protect cables against exposure to mechanical stress.
- Route the cables without mechanical stress – no tensile forces on the connectors
- Cables are only to be installed indoors.
- Observe permissible temperature range (fixed installation) of 263 K (-10 °C) to 343 K (+70 °C).
- Route the motor cables and the data cables separately in metal ducts; if necessary, additional measures must be taken to ensure electromagnetic compatibility (EMC).

Interface for energy supply systems

The robot can be equipped with an energy supply system between axis 1 and axis 3 and a second energy supply system between axis 3 and axis 6. The A1 interface required for this is located on the rear of the base frame, the A3 interface is located on the side of the arm and the interface for axis 6 is located on the robot tool. Depending on the application, the interfaces differ in design and scope. They can be equipped e.g. with connections for cables and hoses. Detailed information on the connector pin allocation, threaded unions, etc. is given in separate documentation.

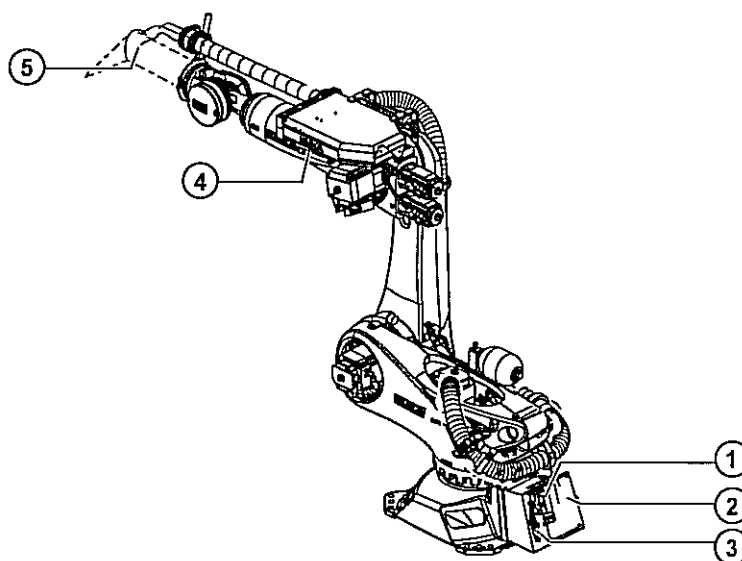


Fig. 6-6: Interfaces on the robot

- | | |
|---------------------------------|---------------------------|
| 1 Connection, motor cable X30 | 4 Interface, axis 3, arm |
| 2 Interface, axis 1, base frame | 5 Interface, axis 6, tool |
| 3 Connection, data cable, X31 | |

7 Transportation

7.1 Transporting the robot

Before transporting the robot, always move the robot into its transport position. It must be ensured that the robot is stable while it is being transported. The robot must remain in its transport position until it has been fastened in position. Before the robot is lifted, it must be ensured that it is free from obstructions. Remove all transport safeguards, such as nails and screws, in advance. First remove any rust or glue on contact surfaces.

Transport position

The robot must be in the transport position (>>> Fig. 7-1) before it can be transported. The robot is in the transport position when the axes are in the following positions:

Axis	A1	A2	A3	A4	A5	A6
Transport position	0°	-120°	-115°	0°	+120°	0°

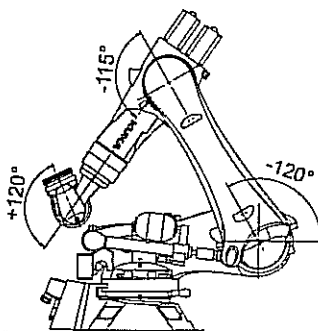


Fig. 7-1: Transport position

Transport dimensions

The transport dimensions (>>> Fig. 7-2) for the robot can be noted from the following diagram. The position of the center of gravity and the weight vary according to the specific configuration and the position of axes 2 and 3. The specified dimensions refer to the robot without equipment.

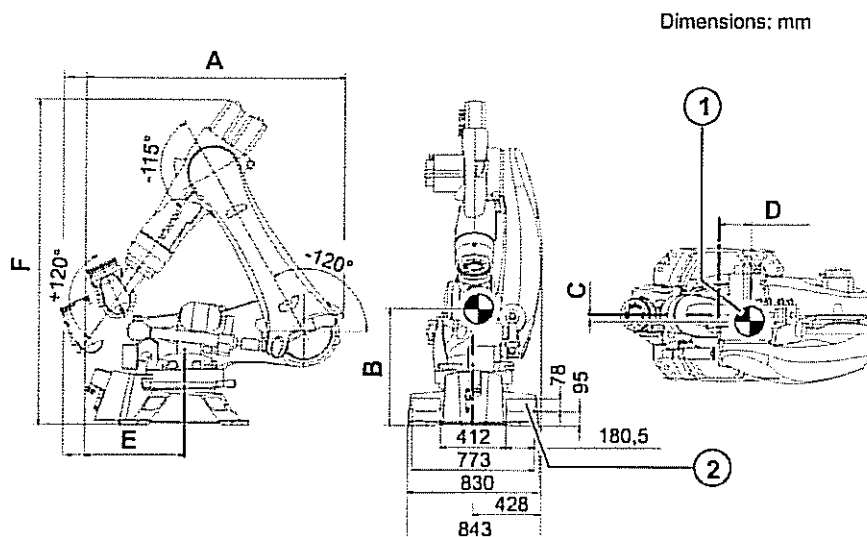


Fig. 7-2: Transport dimensions

- 1 Center of gravity
- 2 Fork slots

Transport dimensions and centers of gravity

Robot with reach	A	B	C	D	E	F
R2900	1628	737	41	190	630	2042
R3100	1701	722	43	187	703	2042
R3300	1801	778	46	165	803	2215
R3500	1916	766	46	151	918	2215
R3700	2031	766	45	140	1032	2215

Transportation

The robot can be transported by fork lift truck or using lifting tackle.



WARNING Use of unsuitable handling equipment may result in damage to the robot or injury to persons. Only use authorized handling equipment with a sufficient load-bearing capacity. Only transport the robot in the manner specified here.

Transportation by fork lift truck

For transport by fork lift truck (>>> Fig. 7-3), two fork slots are provided in the base frame. The robot can be picked up by the fork lift truck from the front and rear. The base frame must not be damaged when inserting the forks into the fork slots. The fork lift truck must have a minimum payload capacity of 2.0 t and an adequate fork length.

Ceiling-mounted robots can only be transported by fork lift truck.

For installation situations in which the fork slots are not accessible, the "Recovery aid" accessory is available. With this device, the robot can also be transported using the fork lift truck.



NOTICE Avoid excessive loading of the fork slots through undue inward or outward movement of hydraulically adjustable forks of the fork lift truck.

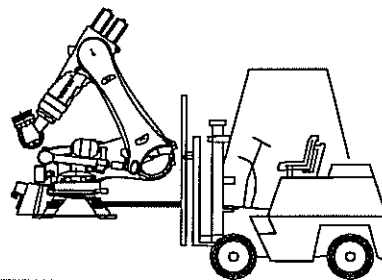


Fig. 7-3: Transportation by fork lift truck

Transportation with lifting tackle

The robot can also be transported using lifting tackle (>>> Fig. 7-4). The robot must be in the transport position. The lifting tackle is attached at 3 points to M16 DIN 580 eyebolts. All ropes must be long enough and must be routed in such a way that the robot, or the energy supply system for example, is not damaged.

Installed tools and pieces of equipment can cause undesirable shifts in the center of gravity.

⚠ WARNING The robot may tip during transportation. Risk of personal injury and damage to property.
If the robot is being transported using lifting tackle, special care must be exercised to prevent it from tipping. Additional safeguarding measures must be taken. It is forbidden to pick up the robot in any other way using a crane!

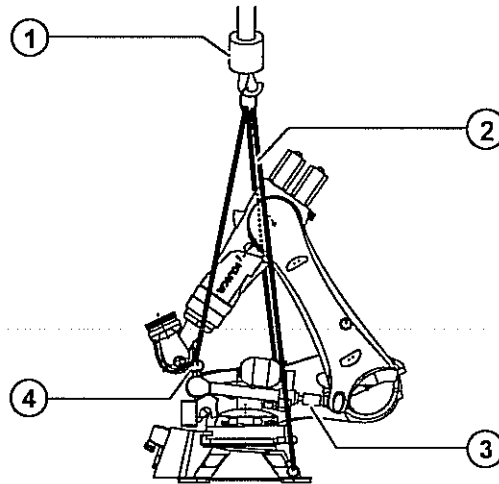


Fig. 7-4: Transportation using lifting tackle

- | | |
|------------------|-------------------|
| 1 Crane | 3 Rotating column |
| 2 Lifting tackle | 4 M16 eyebolt |

8 Start-up and recommissioning

8.1 Installation of the mounting base

Description These instructions apply to the "mounting base with centering" variant. The robot is fastened to an appropriate concrete foundation using 4 bedplates and resin-bonded anchors.

If the surface of the concrete foundation is not sufficiently smooth and even, the differences must be evened out with a suitable leveling compound.

When using a Dynamic Set and resin-bonded anchors, use only components and resin capsules from the same manufacturer. No diamond tools or core drills may be used for drilling the anchor holes; for preference, drilling tools supplied by the anchor manufacturer are to be used. Observe also the manufacturer's instructions for the use of resin-bonded anchors.

Preconditions

- The concrete foundation must have the required dimensions and cross-section.
- The surface of the foundation must be smooth and even.
- The mounting base assembly must be complete.
- Have the leveling compound readily at hand.

Special tools The following special tools are required:

- Drill with a $\varnothing$ 18 mm bit
- Setting tool approved by the anchor manufacturer

Procedure

1. Lift the robot with fork lift truck or lifting tackle.
2. Fasten the 4 bedplates to the robot using two M24x65-8.8-A2K hexagon bolts and lock washers for each one; $M_A = 640$ Nm.
2 bedplates are fitted with pins for centering.
3. Determine the position of the robot on the foundation in relation to the working envelope.
4. Set the robot down on the foundation in its installation position.
5. Align the manipulator horizontally. For this, an M20 thread is provided in each bedplate.

NOTICE If the bedplates are not fully seated on the concrete foundation, this can result in distortion or loosening of the mounting base. Fill any gaps with leveling compound. To do this, lift the robot again and apply sufficient leveling compound to the underside of the bedplates. Then set the robot down again and align it, removing any excess leveling compound.

6. Only if leveling compound is used.
Allow the leveling compound to cure for about 3 hours. The curing time is longer at temperatures below 293 K (+20 °C).
7. Drill 12 anchor holes (>>> Fig. 8-1) (5) through the holes of the bedplates into the foundation.
8. Clean the anchor holes.
9. Insert 12 resin capsules one after the other.
10. Clamp the setting tool with the chemical anchor rod in the drill and insert it into the anchor hole at max. 750 rpm. The chemical anchor rod is set correctly if the resin is completely mixed and the anchor hole in the concrete is completely filled to the upper edge.

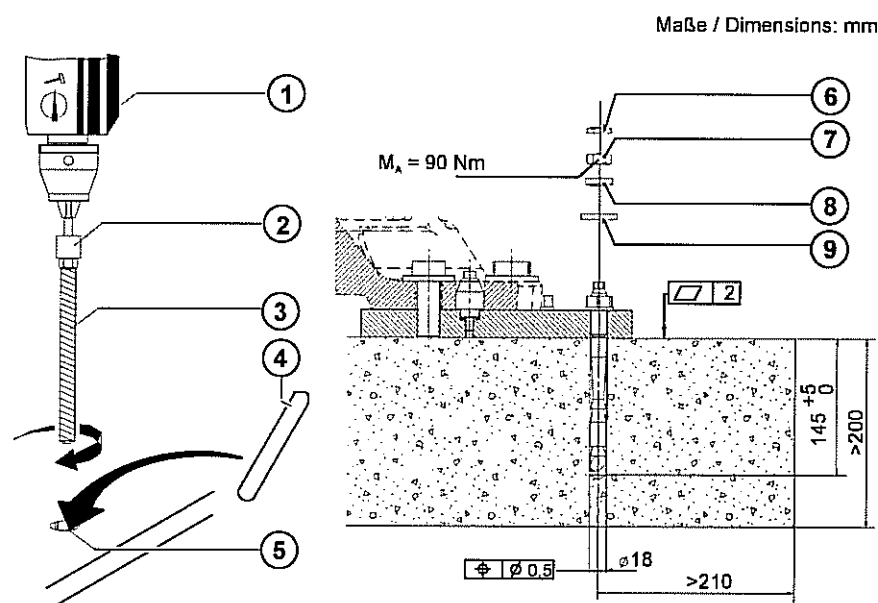


Fig. 8-1: Installation of resin-bonded anchors

- | | |
|-----------------------|--------------------|
| 1 Drill | 6 Lock nut |
| 2 Setting tool | 7 Hexagon nut |
| 3 Chemical anchor rod | 8 Spherical washer |
| 4 Resin capsule | 9 Filling disc |
| 5 Anchor hole | |

11. Repeat step 12 for all chemical anchors.

12. Allow the resin to cure. See table, or as specified by manufacturer. These values are guide values.

Temperature	Time
$\geq 293 \text{ K } (+20 \text{ }^{\circ}\text{C})$	20 minutes
$\geq 283 \text{ K } (+10 \text{ }^{\circ}\text{C})$	30 minutes
$\geq 273 \text{ K } (0 \text{ }^{\circ}\text{C})$	1 hour

13. Mount filling disc and spherical washer.

14. Fit hexagon nuts and tighten with a torque wrench in diagonally opposite sequence, increasing the tightening torque to 90 Nm in several stages.

15. Fit and tighten the lock nut.

16. Inject injection resin into the hole on the filling disc until the cavity is completely filled. Observe the curing time.

The mounting base and robot are now ready for connection.

8.2 Installation of the machine frame mounting assembly

Description	The machine frame mounting assembly is used for installing robots on a steel structure prepared by the customer or on the carriage of a linear unit.
Preconditions	≡ The mounting surface is prepared as shown in the diagram (>>> Fig. 6-5). ≡ The substructure is checked for sufficient safety. ≡ The machine frame mounting assembly is complete.
Procedure	1. Clean the mounting surface (>>> Fig. 8-2) (3) of the robot. 2. Check the hole pattern.

3. Insert 2 pins and 2 M8x55-8.8 Allen screws with conical spring washers and tighten with a torque wrench; $M_A = 23.9 \text{ Nm}$.
4. Prepare 8 M24x65-8.8-A2K hexagon bolts and conical spring washers.

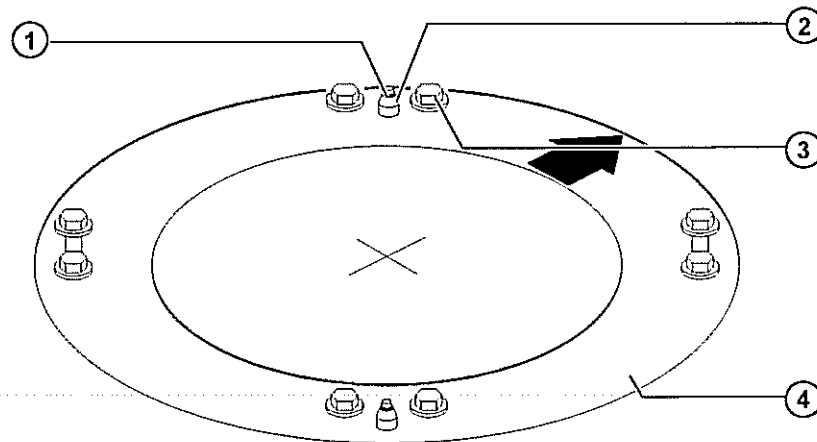


Fig. 8-2: Installing the machine frame mounting assembly

- | | |
|--|---|
| 1 Pin | 3 Hexagon bolt with conical spring washer, 8x |
| 2 Allen screw with conical spring washer, 2x | 4 Mounting surface |

The mounting base is now ready for the robot to be installed.

8.3 Installing the robot

Description

This description is valid for the installation of robots on the floor, with the mounting variants: mounting base, machine frame mounting and adapter plates.

The installation and start-up of the robot controller, the tools mounted and the applications are not described here.

Precondition

- The required mounting base is installed.
- The installation site is accessible with a crane or fork lift truck.
- Any tools or other system components which would hinder the work have been removed.
- The robot is in the transport position.
- The connecting cables and ground conductors are routed to the robot and installed.
- Compressed air supply to the robot available; F variant only

Procedure

1. Check that both pins (>>> Fig. 8-3) are undamaged and fitted securely.
2. Bring the robot to the installation site by crane or fork lift truck.
The lifting tackle must not damage the robot.
3. Clean the mounting surface on the robot.
4. Lower the robot vertically onto the mounting base. Ensure that an entirely vertical position is maintained in order to prevent damage to the pins.
5. Insert 8 M24x65-8.8 hexagon bolts with conical spring washers.
6. Tighten the hexagon bolts with torque wrench. Gradually increase the tightening torque to 640 Nm.
7. Remove the lifting tackle and eyebolts or the fork slots.

8. Connect motor cable X30 and data cable X31.
9. Connect the ground conductor between the robot controller and the robot to the ground conductor connection.
10. Connect the ground conductor between the system component and the robot to the ground conductor connection (5).
11. Check the equipotential bonding in accordance with VDE 0100 and EN 30204-1.



Further information is contained in the assembly or operating instructions for the robot controller.

12. Connect compressed air supply to the pressure regulator and set the pressure regulator to zero; F variant only.
13. Open compressed air supply and set pressure regulator to 0.01 MPa (0.1 bar); F variant only.
14. Mount tooling, if required.
15. Retighten the hexagon bolts with a torque wrench after 100 hours of operation.

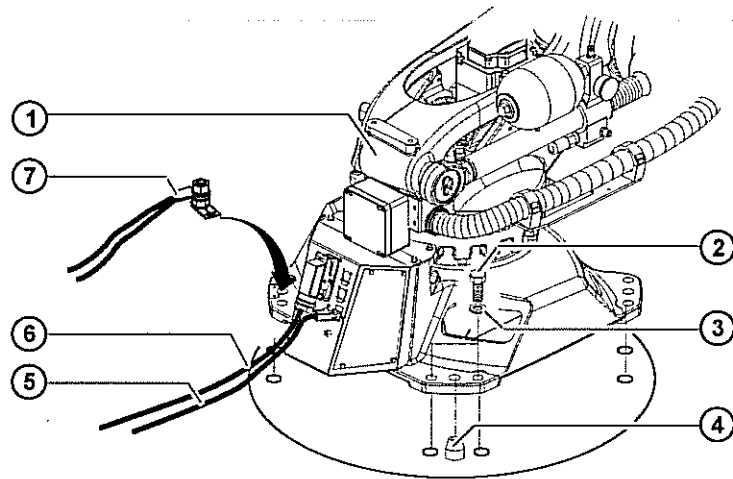


Fig. 8-3: Installing the robot

- | | |
|-------------------------|-------------------------------|
| 1 Rotating column | 5 Data cable |
| 2 Hexagon bolt | 6 Motor cable |
| 3 Conical spring washer | 7 Ground conductor connection |
| 4 Pin | |

Put the robot into operation in accordance with the "Start-up" chapter of the operating and programming instructions for the KUKA System Software and the assembly instructions or operating instructions for the robot controller.

9 Electrical installations

9.1 Description of the electrical installations (robot)

Overview	The electrical installations of the robot consist of: ■ Cable set ■ Multi-function housing MFH for motor cable ■ Junction box for data cable, RDC box
Description	The electrical installations (>>> Fig. 9-1) include all the supply and control cables for the motors of axes 1 to 6. All the connections on the motors are screwed plug-and-socket connections. The assembly consists of the cable set, the multi-function housing MFH on the push-in module and the RDC box in the rotating column. The interface for the connecting cables is located at the back of the base frame on the push-in module. The motor cable X30 and the data cable X31 are connected here via plug-in connections. The data and motor cables are routed through the axis 1 gear unit to the motors (XM connectors) or, in the case of the data cables, to the RDC box on the rotating column. From the RDC box, the motors are connected via the XP connectors. The connectors on motors A1 to A5 are freely accessible, whereas the connectors for motor A6 are only accessible after removal of the wrist. The protective circuit is also integrated into the cable set. The ground conductor is connected to the base frame via a ground conductor bolt. The selected cable routing ensures that the cables are guided without strain or kinking throughout the entire motion range of the robot. The following diagram gives an overview of the installation and routing of the cables on the manipulator.

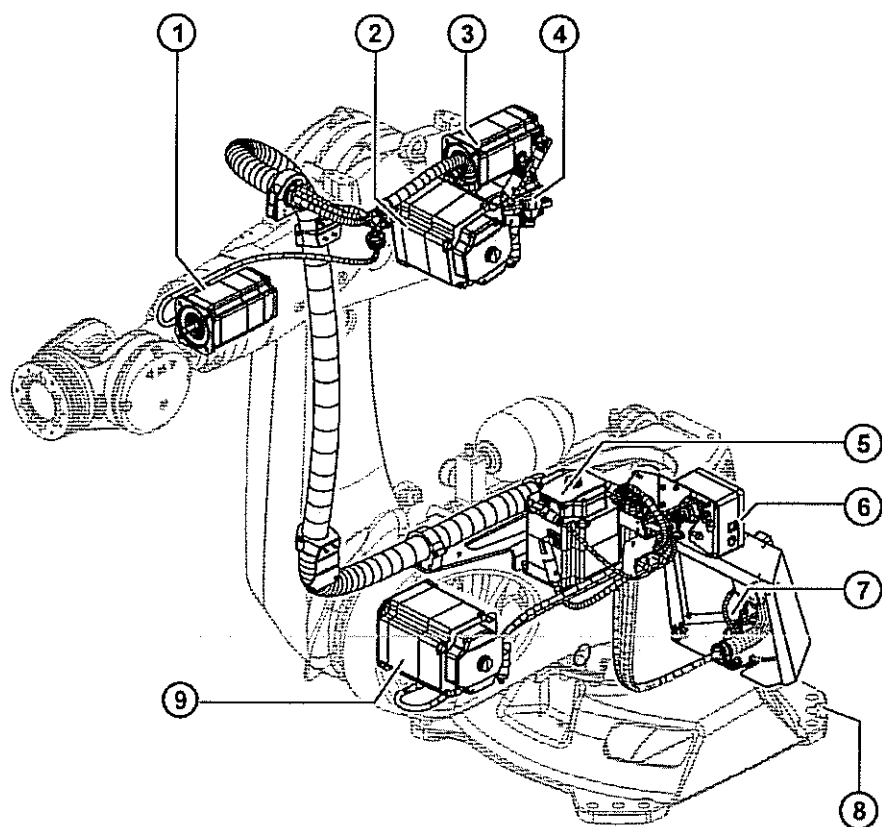


Fig. 9-1: Electrical installations, overview

- | | | | |
|---|--------------|---|----------------|
| 1 | Axis 6 motor | 6 | RDC box |
| 2 | Axis 3 motor | 7 | Push-in module |
| 3 | Axis 4 motor | 8 | Base frame |
| 4 | Axis 5 motor | 9 | Axis 2 motor |
| 5 | Axis 1 motor | | |

Wiring diagrams

Designation	Connection	Figure
Wiring diagram A1	XM1	(>>> Fig. 9-2)
Wiring diagram A2	XM2	(>>> Fig. 9-3)
Wiring diagram A3	XM3	(>>> Fig. 9-4)
Wiring diagram A4	XM4	(>>> Fig. 9-5)
Wiring diagram A5	XM5	(>>> Fig. 9-5)
Wiring diagram A6	XM6	(>>> Fig. 9-7)
Data cable	Wiring diagram, RDC X31	(>>> Fig. 9-8)
Data cable	Wiring diagram, RDC X32	(>>> Fig. 9-9)
Protective circuit	Ring cable lug	(>>> Fig. 9-10)

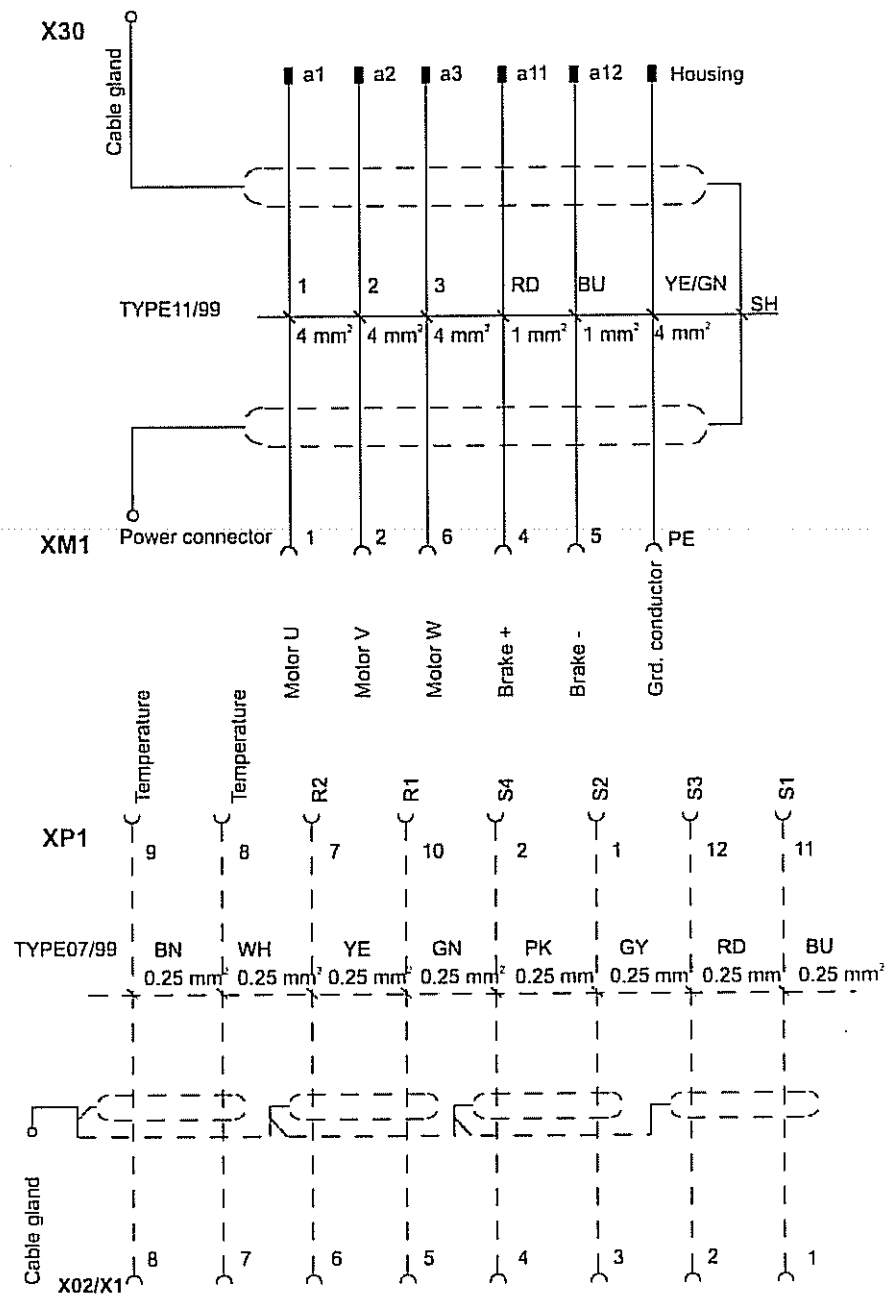


Fig. 9-2: Wiring diagram, axis 1

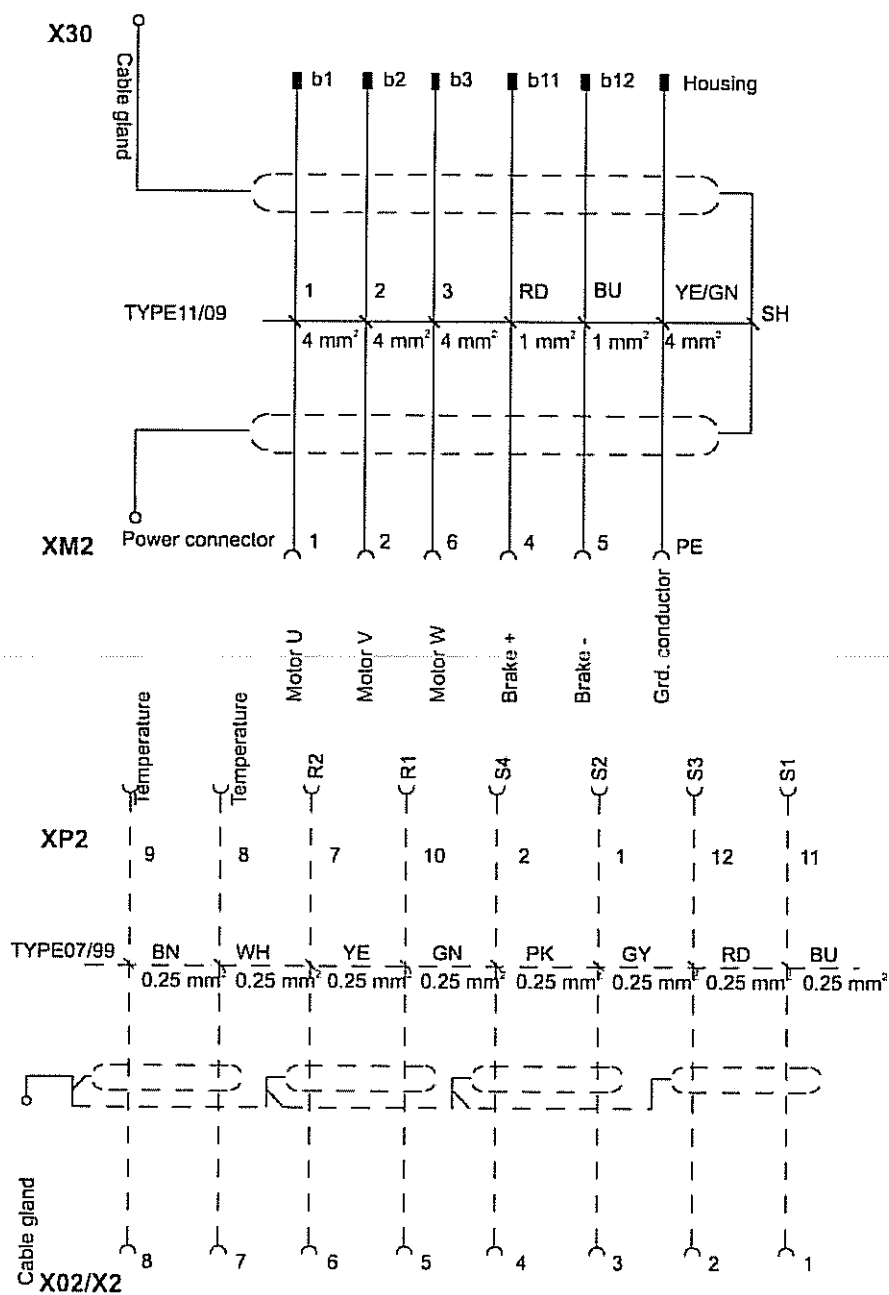


Fig. 9-3: Wiring diagram, axis 2

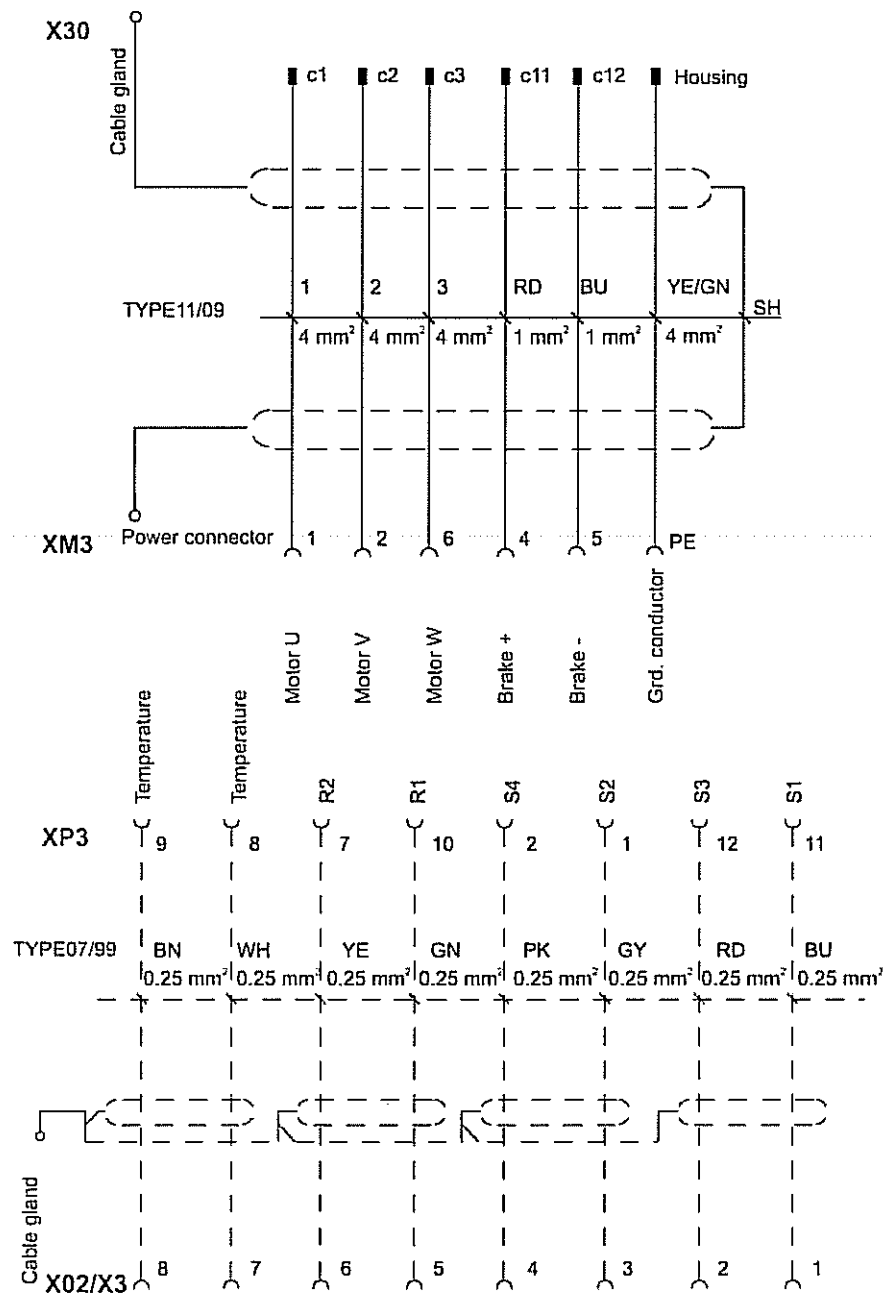


Fig. 9-4: Wiring diagram, axis 3

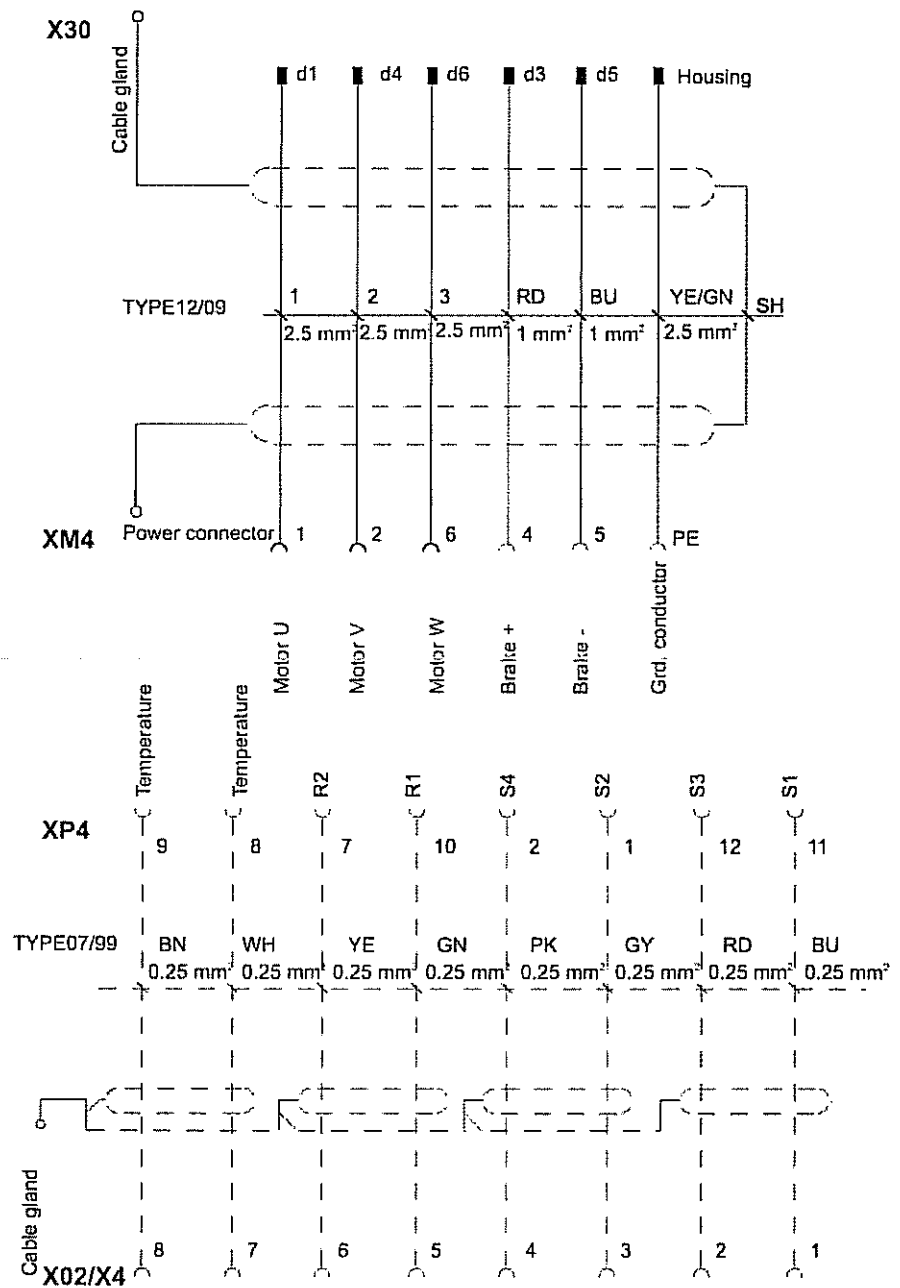


Fig. 9-5: Wiring diagram, axis 4

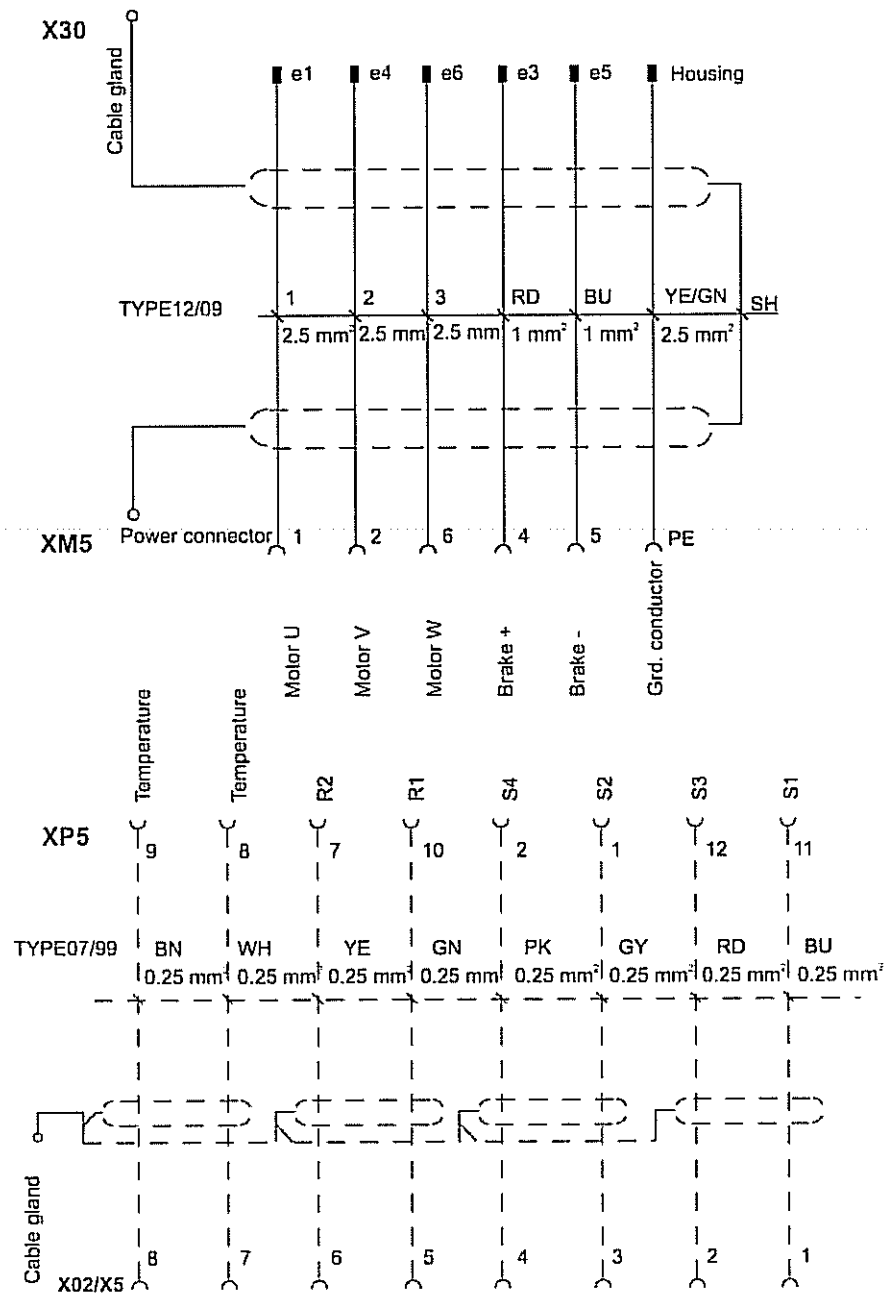


Fig. 9-6: Wiring diagram, axis 5

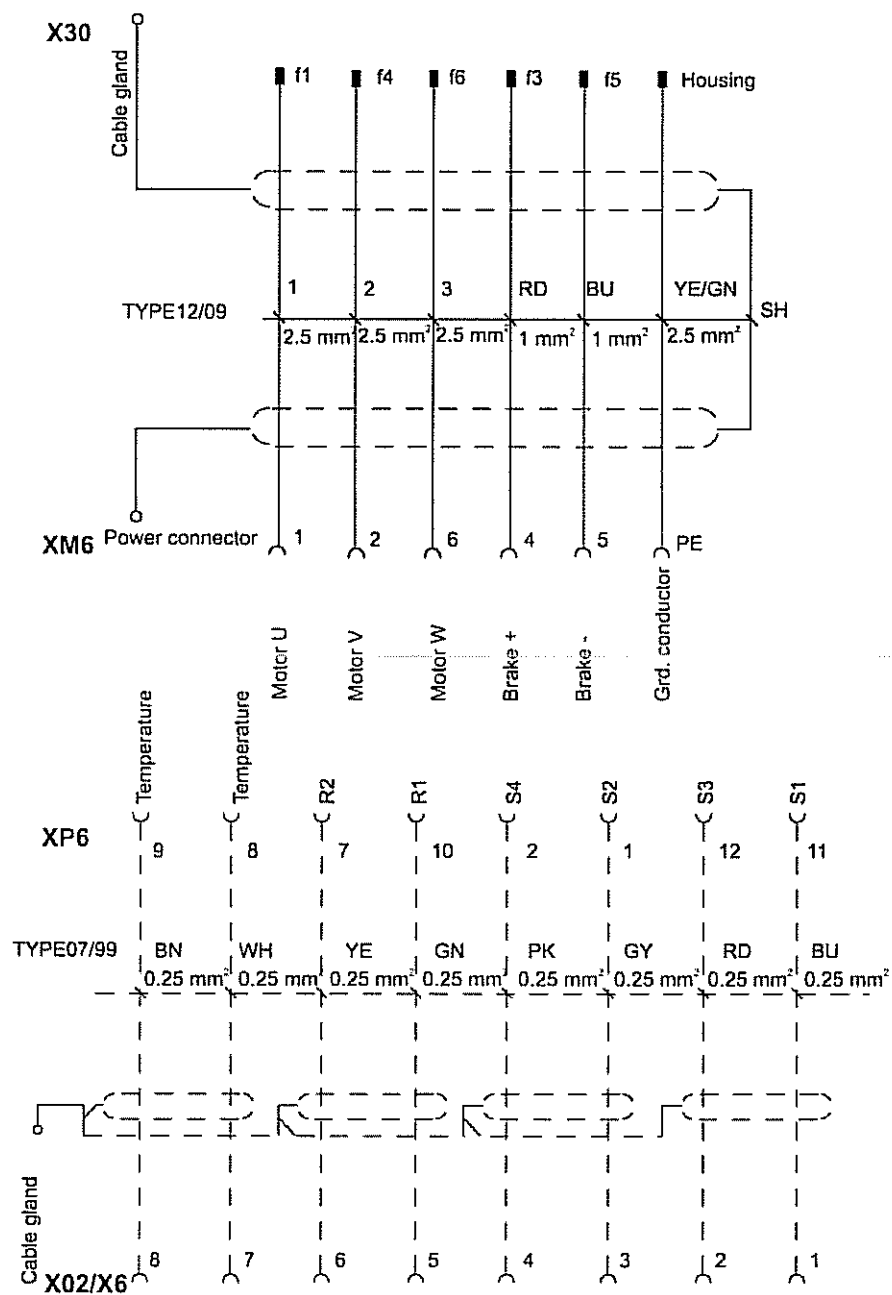


Fig. 9-7: Wiring diagram, axis 6

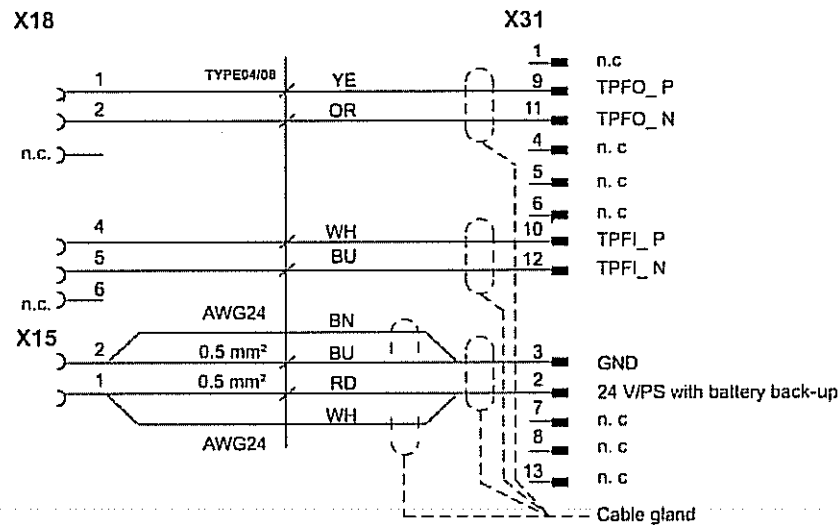


Fig. 9-8: Wiring diagram, RDC X31

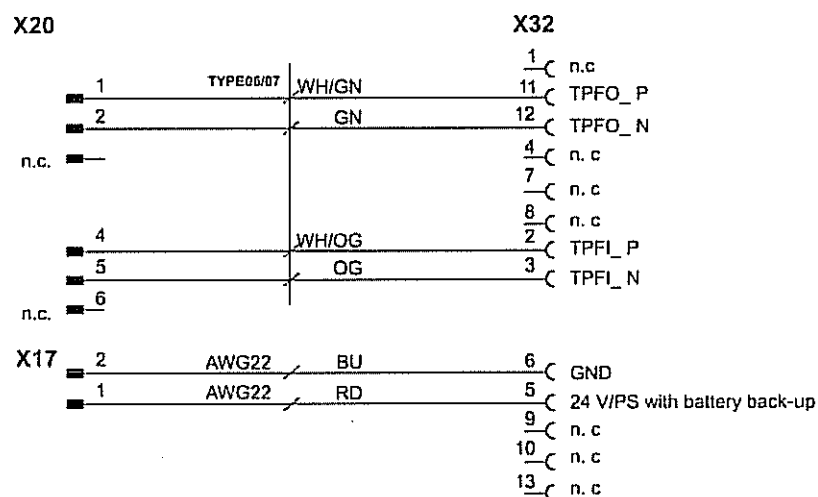


Fig. 9-9: Wiring diagram, RDC X32

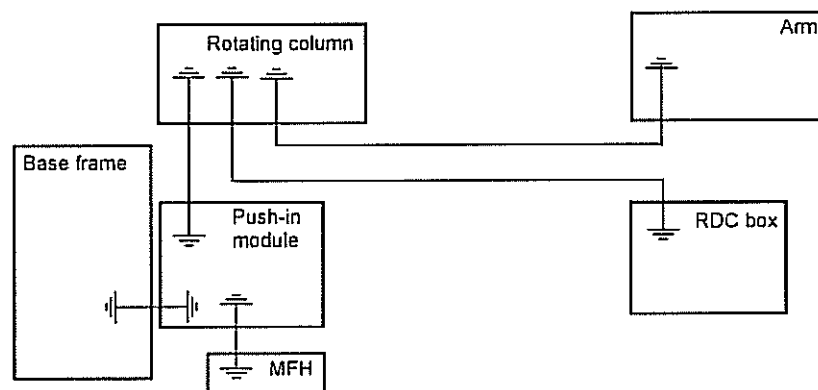
All ground conductor cross-sections 10 mm²

Fig. 9-10: Wiring diagram, protective circuit

9.2 Description of the connecting cables

Configuration The connecting cables are used to transfer power and signals between the robot controller and the robot.

The connecting cables comprise:

- Motor cable
- Data cable
- Ground conductor (order as an option)

Interface For connection of the connecting cables between the robot controller and the robot, the following connectors are available at the interfaces:

Cable designation	Connector designation robot controller – robot	Connection
Motor cable	X20 - X30	HAN size 24
Data cable	X21 - X31	Rectangular connector
Ground conductor / equipotential bonding 16 mm ² can be ordered as an option		M8 ring cable lug



For the connecting cables, a ground conductor is always required to provide a low-resistance connection between the robot and the control cabinet in accordance with DIN EN 60204. The ground conductor is not part of the scope of supply and can be ordered as an option. The connection must be made by the customer. The tapped holes for connecting the ground conductor are located on the base frame of the robot.

**Standard
connecting cable**

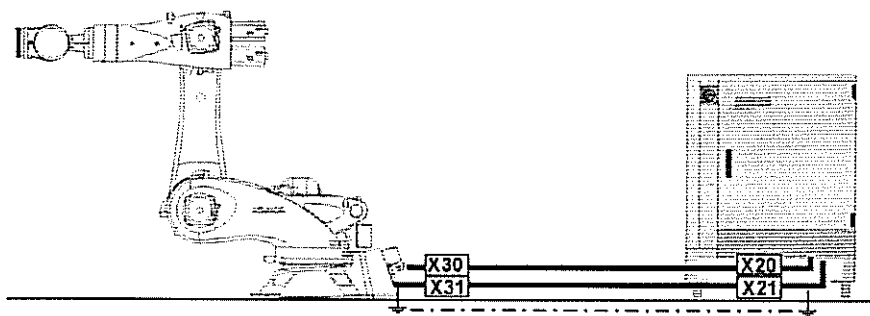


Fig. 9-11: Connecting cables, overview

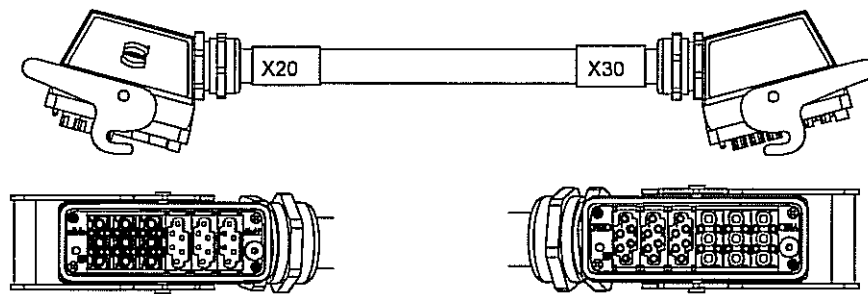


Fig. 9-12: Connecting cable, motor cable, X20 - X30

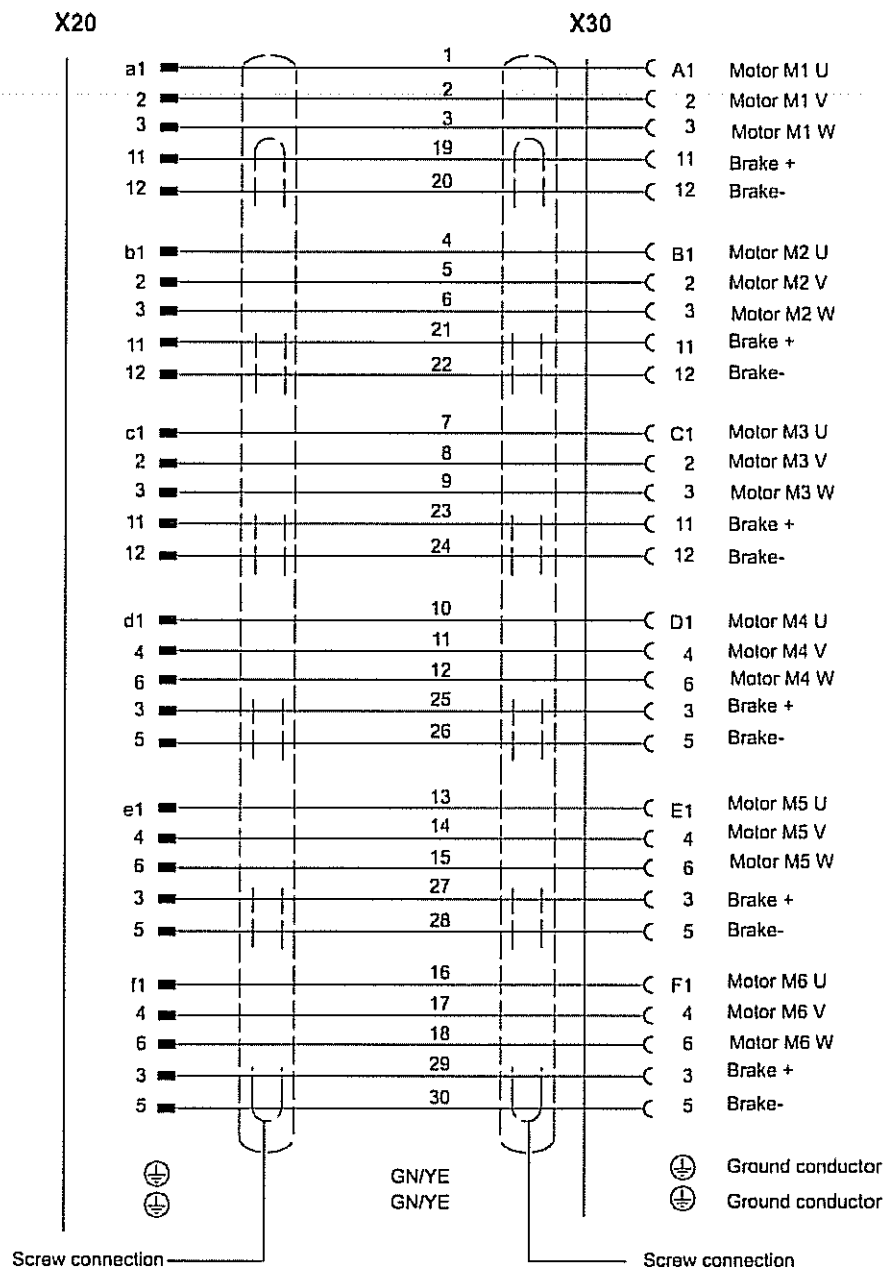


Fig. 9-13: Connecting cable, wiring diagram, motor cable

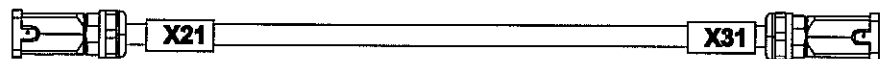


Fig. 9-14: Connecting cable, data cable X21 - X31

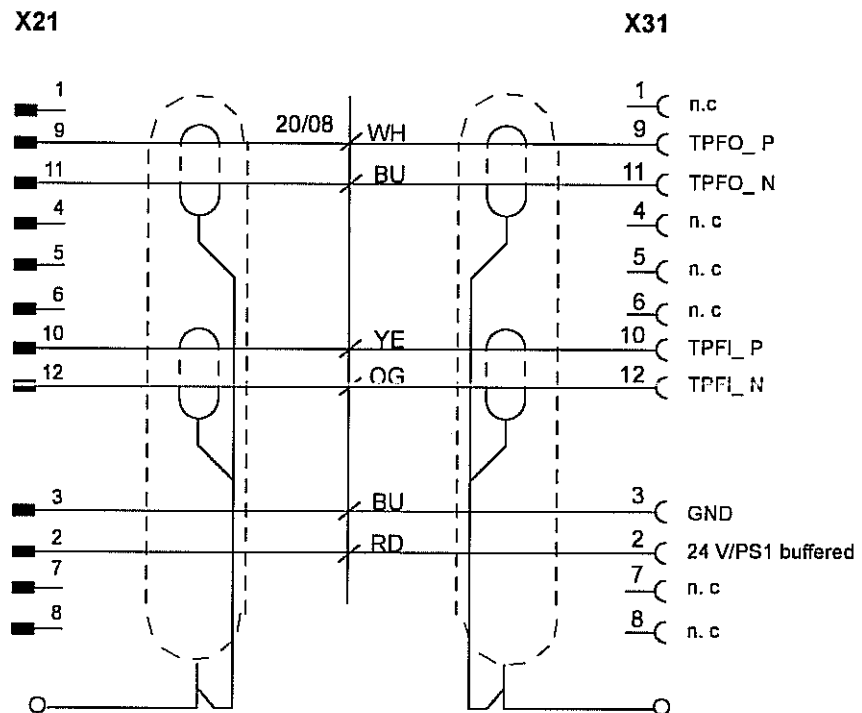


Fig. 9-15: Connecting cable, wiring diagram, data cable X21 - X31

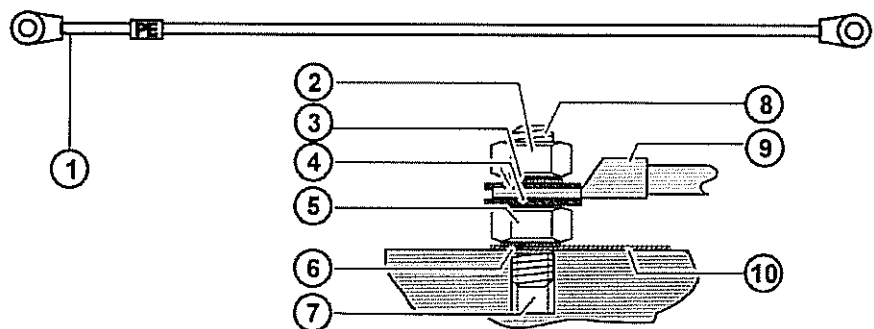


Fig. 9-16: Connecting cable, ground conductor

- | | |
|----------------------------|--|
| 1 Ground conductor | 6 Conical spring washer |
| 2 Hexagon nut | 7 Robot |
| 3 Conical spring washer 2x | 8 Setscrew |
| 4 Plain washer 2x | 9 Ground conductor connection, M8 ring cable lug |
| 5 Hexagon nut | 10 Ground plate |

10 Maintenance

10.1 Maintenance table

Precondition

- The maintenance points must be freely accessible.
- Remove the tools and any additional items of equipment if they impede maintenance work.

⚠ WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

Description

Lubrication is performed either at the specified maintenance intervals or every 5 years after commissioning by the customer. With a maintenance interval of 10,000 operating hours, for example, the first maintenance (oil change) is performed either after 10,000 operating hours or 5 years after commissioning by the customer, whichever is reached first.

The maintenance intervals given in the tables are valid for the operating conditions specified in the technical data (>>> 4 "Technical data" Page 17). In case of variations from normal conditions (e.g. increased dust or water content in the environment of the robot, abnormal temperatures), KUKA Roboter GmbH must be consulted. Special maintenance intervals apply for F variant robots.

If the robot is fitted with a KUKA energy supply system (optional), additional maintenance work must be carried out.

NOTICE Only lubricants approved by KUKA Roboter GmbH may be used.

If oil temperatures of more than 333 K (60 °C) are reached during operation, shorter maintenance intervals must be observed; for this, consultation with KUKA Roboter GmbH is necessary.

NOTICE When draining the oil, remember that the quantity drained is dependent on time and temperature. The quantity of oil drained must be determined. Only this quantity of oil may be used when refilling. The oil quantities specified are the actual amounts of oil in the gear unit at first filling. If less than 70% of the specified oil quantity flows out, flush the gear unit with the determined quantity of drained oil once, then pour in the amount of oil that was drained. During the flushing procedure, move the axis at jog velocity throughout the entire axis range.

Maintenance symbols



Oil change



Lubricate with grease gun



Lubricate with brush



Tighten screw/nut



Check component, visual inspection

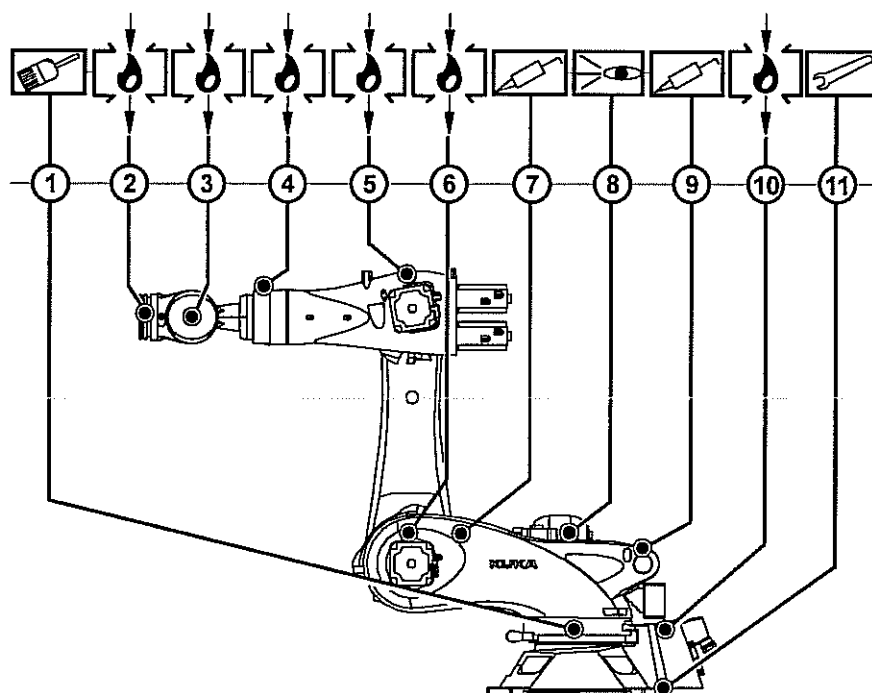


Fig. 10-1: Maintenance work

**Maintenance
table,
payload range
90 kg to 180 kg**

Interval	Item	Activity	Lubricant
Once only, after 100 h	11	Check bolts M_A 640 Nm	
5,000 h or 1 year at the latest 1)	7	Counterbalancing system bearing, link arm, lubricate. Grease nipples in the mid- dle position and at the plus and minus end positions of axis 2.	SKF LGEP 2 Art. no. 00-119-990 10 cm ³
5,000 h or 1 year at the latest 1)	9	Counterbalancing system bearing, rotating column, lubricate. Grease nipples in the mid- dle position and at the plus and minus end positions of axis 2.	SKF LGEP 2 Art. no. 00-119-990 10 cm ³
5,000 h	8	Counterbalancing system, check pressure Setpoint, tolerance -5 bar	Hyspin ZZ 46 Art. no. 83-236-202

Interval	Item	Activity	Lubricant
10,000 h	1	Grease cables of cable set and energy supply system. (>>> 10.8 "Greasing the cable set" Page 118)	Cable grease RB1 00-101-456 200 cm ³
20,000 h or 5 years at the latest	2	Oil change, gear unit A6. (>>> 10.7 "Changing the gear oil on axis 6" Page 117)	Optigear Synthetic RO 150 Art. no. 00-144-898 1.000 l
20,000 h or 5 years at the latest	3	Oil change, gear unit A5. (>>> 10.6 "Changing the gear oil on axis 5" Page 116)	Optigear Synthetic RO 150 Art. no. 00-144-898 0.900 l
20,000 h or 5 years at the latest	4	Oil change, gear unit A4. (>>> 10.5 "Changing the gear oil on axis 4" Page 115)	Optigear Synthetic RO 150 Art. no. 00-144-898 2.100 l
20,000 h or 5 years at the latest	5	Oil change, gear unit A3.	Optigear Synthetic RO 150 Art. no. 00-144-898 1.800 l
20,000 h or 5 years at the latest	6	Oil change, gear unit A2. (>>> 10.3 "Changing the gear oil on axis 2" Page 112)	Optigear Synthetic RO 150 Art. no. 00-144-898 2.900 l
20,000 h or 5 years at the latest	10	Oil change, gear unit A1. (>>> 10.2 "Changing the gear oil on axis 1" Page 110)	Optigear Synthetic RO 150 Art. no. 00-144-898 6.500 l

1) In the case of frequently recurring, short-distance movements, the maintenance interval is 3000 hours.

Maintenance
table,
payload range
210 kg

Interval	Item	Activity	Lubricant
Once only, after 100 h	11	Check bolts M _A 640 Nm	
5,000 h or 1 year at the latest 1)	7	Counterbalancing system bearing, link arm, lubricate. Grease nipples in the mid- dle position and at the plus and minus end positions of axis 2.	SKF LGEP 2 Art. no. 00-119-990 10 cm ³
5,000 h or 1 year at the latest 1)	9	Counterbalancing system bearing, rotating column, lubricate. Grease nipples in the mid- dle position and at the plus and minus end positions of axis 2.	SKF LGEP 2 Art. no. 00-119-990 10 cm ³

Interval	Item	Activity	Lubricant
5,000 h	8	Counterbalancing system, check pressure Setpoint, tolerance -5 bar	Hyspin ZZ 46 Art. no. 83-236-202
10,000 h	1	Grease cables of cable set and energy supply system. (>>> 10.8 "Greasing the cable set" Page 118)	Cable grease RB1 00-101-456 200 cm³
20,000 h or 5 years at the latest	2	Oil change, gear unit A6. (>>> 10.7 "Changing the gear oil on axis 6" Page 117)	Optigear Synthetic RO 150 Art. no. 00-144-898 1.200 l
20,000 h or 5 years at the latest	3	Oil change, gear unit A5. (>>> 10.6 "Changing the gear oil on axis 5" Page 116)	Optigear Synthetic RO 150 Art. no. 00-144-898 1.100 l
20,000 h or 5 years at the latest	4	Oil change, gear unit A4. (>>> 10.5 "Changing the gear oil on axis 4" Page 115)	Optigear Synthetic RO 150 Art. no. 00-144-898 2.100 l
20,000 h or 5 years at the latest	5	Oil change, gear unit A3. (>>> 10.4 "Changing the gear oil on axis 3" Page 113)	Optigear Synthetic RO 150 Art. no. 00-144-898 1.800 l
20,000 h or 5 years at the latest	6	Oil change, gear unit A2. (>>> 10.3 "Changing the gear oil on axis 2" Page 112)	Optigear Synthetic RO 150 Art. no. 00-144-898 2.900 l
20,000 h or 5 years at the latest	10	Oil change, gear unit A1. (>>> 10.2 "Changing the gear oil on axis 1" Page 110)	Optigear Synthetic RO 150 Art. no. 00-144-898 6.500 l

1) In the case of frequently recurring, short-distance movements, the maintenance interval is 3000 hours.

The description of the following oil change work applies to all robot variants, irrespective of the variant shown.

10.2 Changing the gear oil on axis 1

Preconditions

- The gear unit is at operating temperature.



WARNING

If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.

⚠ WARNING

Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.

Procedure, draining oil

1. Remove 4 Allen screws with conical spring washers, and take off interface A1 or cover (>>> Fig. 10-2).
2. Pull out the oil drain hose.
3. Place a suitable receptacle under the oil drain hose.
4. Unscrew the union nut of the oil drain hose.
5. Remove the magnetic screw plug.
6. Drain the oil.
7. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.

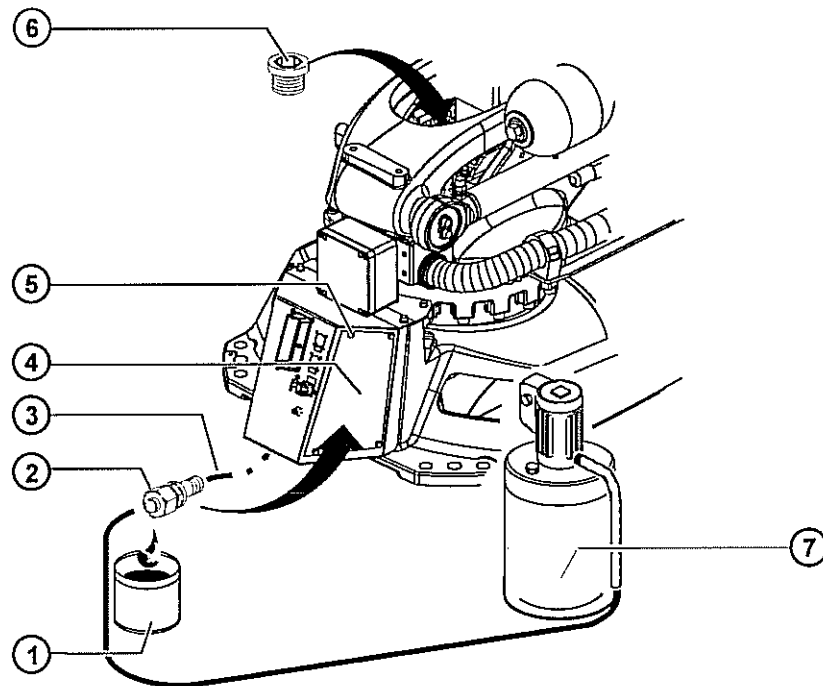


Fig. 10-2: Oil change, A1

- | | | | |
|---|----------------|---|---------------------|
| 1 | Receptacle | 5 | Allen screws |
| 2 | Sealing cap | 6 | Magnetic screw plug |
| 3 | Oil drain hose | 7 | Oil pump |
| 4 | Cover | | |

Procedure, filling with oil

1. Fill the specified amount of oil from below via the oil drain hose using the oil pump.
2. Screw the sealing cap onto the oil drain hose.
3. Clean the magnetic screw plug and check the sealing element; exchange the magnetic screw plug if damaged.
4. Insert and tighten the magnetic screw plug; $M_A = 25 \text{ Nm}$.
5. Check the sealing cap for leaks.

6. Stow the oil drain hose in the base frame.
7. Mount interface A1 or cover and fasten it with 4x M6x16 Allen screws and conical spring washers.

10.3 Changing the gear oil on axis 2

Preconditions

- The robot is in a position in which the oil filler and drain holes on the axis 2 gear unit are accessible.
- The gear unit is at operating temperature.

⚠ WARNING

If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.

⚠ WARNING

Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.

Procedure, draining oil

1. Pull the oil drain hose (>>> Fig. 10-3) out of the rotating column.
2. Release and unscrew the sealing cap.
3. Place a suitable receptacle under the oil drain hose and remove the magnetic screw plug.
4. Catch the oil in the receptacle as it drains out.
5. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.
6. Check the magnetic screw plug for deposits; take appropriate measures if necessary.

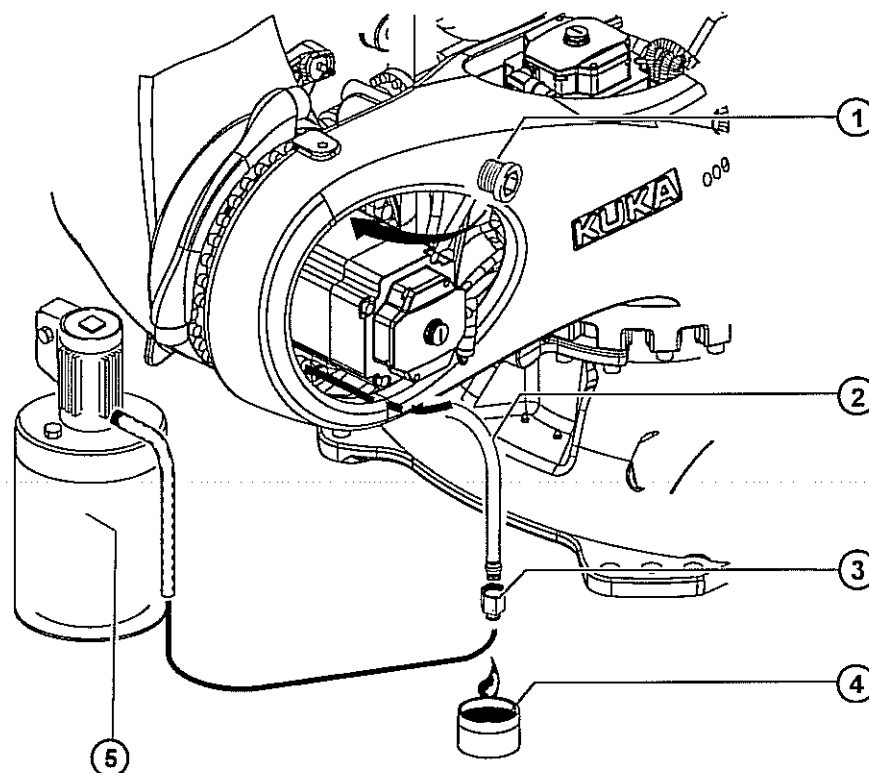


Fig. 10-3: Oil change, A2

- | | | | |
|---|---------------------|---|------------|
| 1 | Magnetic screw plug | 4 | Receptacle |
| 2 | Oil drain hose | 5 | Oil pump |
| 3 | Sealing cap | | |

Procedure, filling with oil

1. Fill the same amount of oil as was drained, from below via the oil drain hose, using the oil pump.
2. Screw on the the sealing cap and tighten it.
3. Clean the M18x1.5 magnetic screw plug and check the sealing element; exchange the magnetic screw plug if damaged.
4. Insert and tighten the M18x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
5. Check the magnetic screw plug and sealing cap for leaks.

10.4 Changing the gear oil on axis 3

Preconditions

- The robot is in a position in which the oil filler and drain holes on the axis 3 gear unit are accessible.
- The gear unit is at operating temperature.
- Axis 3 is in a horizontal position.

WARNING

If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.

WARNING

Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.

Procedure, draining oil

1. Place a suitable receptacle (>>> Fig. 10-4) under the (lower) magnetic screw plug and remove the magnetic screw plug.
It is easier to drain the oil if an M16x1.5 oil drain hose is screwed into the tapped hole of the magnetic screw plug.
2. Remove the (upper) magnetic screw plug.
3. Catch the oil in the receptacle as it drains out.
4. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.
5. Check the magnetic screw plugs for deposits; take appropriate measures if necessary.

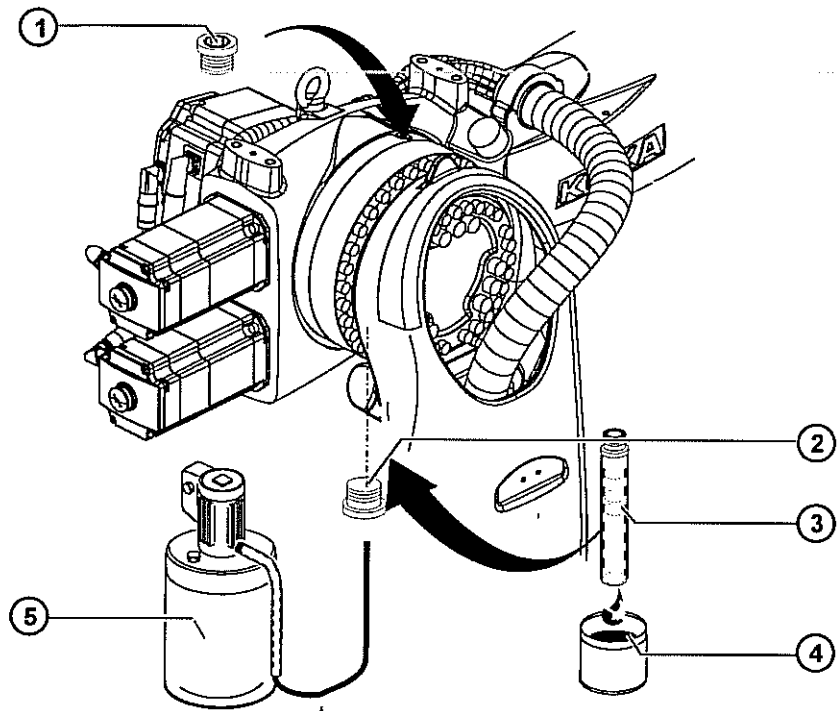


Fig. 10-4: Oil change, A3

- | | | | |
|---|---------------------|---|------------|
| 1 | Magnetic screw plug | 4 | Receptacle |
| 2 | Magnetic screw plug | 5 | Oil pump |
| 3 | Oil drain hose | | |

Procedure, filling with oil

1. Fill the same amount of oil as was drained, from below via the oil drain hose, using the oil pump.
2. Clean the M16x1.5 magnetic screw plug (top) and check the sealing element; exchange the magnetic screw plug if damaged.
3. Insert and tighten the (upper) M16x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
4. Remove the oil drain hose.
5. Clean the M16x1.5 magnetic screw plug (bottom) and check the sealing element; exchange the magnetic screw plug if damaged.
6. Insert and tighten the (lower) M16x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.

7. Check both magnetic screw plugs for leaks.

10.5 Changing the gear oil on axis 4

Preconditions

- The gear unit is at operating temperature.
- Axis 3 is in a horizontal position.

⚠ WARNING If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.

⚠ WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button. Warn all persons concerned before starting to put it back into operation.

Procedure, draining oil

1. Place a suitable receptacle (>>> 10.5 "Changing the gear oil on axis 4" Page 115) under the (lower) magnetic screw plug and remove the magnetic screw plug.
It is easier to drain the oil if an M18x1.5 oil drain hose is screwed into the tapped hole of the magnetic screw plug.
2. Remove the (upper) magnetic screw plug.
3. Catch the oil in the receptacle as it drains out.
4. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.
5. Check the magnetic screw plug for deposits; take appropriate measures if necessary.
6. Remove the oil drain hose if necessary.

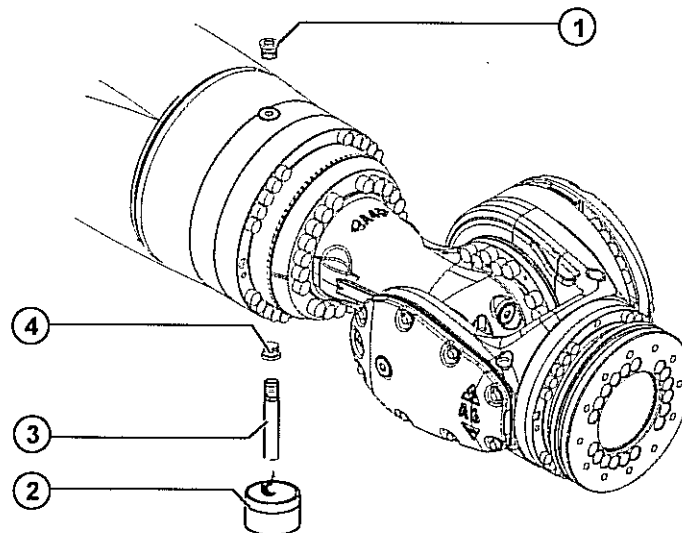


Fig. 10-5: Oil change, A4

- | | |
|-----------------------|-----------------------|
| 1 Magnetic screw plug | 3 Oil drain hose |
| 2 Receptacle | 4 Magnetic screw plug |

Procedure, filling with oil

1. Clean both M18x1.5 magnetic screw plugs and check the sealing element; exchange magnetic screw plugs if damaged.

2. Insert and tighten the (lower) M18x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
3. Pour in, from above, the same amount of oil as was drained.
4. Insert and tighten the (upper) M18x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
5. Check both magnetic screw plugs for leaks.

10.6 Changing the gear oil on axis 5

Preconditions

- The gear unit is at operating temperature.
- Axis 3 is in a horizontal position.



WARNING If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.



WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

Procedure, draining oil

1. Put the robot into operation, move axis 4 to the $+90^\circ$ position and axis 5 to the $+45^\circ$ position, and then secure the robot.
2. Place a suitable receptacle (>>> Fig. 10-6) under the (lower) magnetic screw plug and remove the magnetic screw plug.
It is easier to drain the oil if an M18x1.5 oil drain hose is screwed into the tapped hole of the magnetic screw plug.
3. Remove the magnetic screw plug (on the side).
4. Catch the oil in the receptacle as it drains out.
5. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.
6. Remove the oil drain hose if necessary.
7. Check the magnetic screw plugs for deposits; take appropriate measures if necessary.
8. Clean both M18x1.5 magnetic screw plugs and check the sealing element; exchange magnetic screw plugs if damaged.
9. Insert and tighten the M18x1.5 magnetic screw plug (on the side); $M_A = 20 \text{ Nm}$.
10. Put the robot into operation, move axis 4 to the -90° position and axis 5 to the 0° position, and then secure the robot by activating the EMERGENCY STOP device.

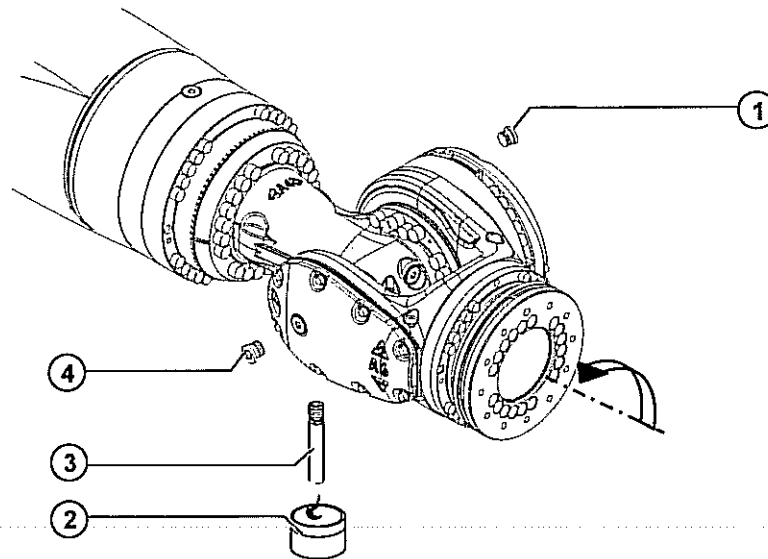


Fig. 10-6: Oil change, A5

- | | | | |
|---|---------------------|---|---------------------------|
| 1 | Magnetic screw plug | 3 | Oil drain hose |
| 2 | Receptacle | 4 | Magnetic screw plug, side |

Procedure, filling with oil

1. Pour in, from above, the same amount of oil as was drained.
2. Insert and tighten the (upper) M18x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
3. Check both magnetic screw plugs for leaks.

10.7 Changing the gear oil on axis 6

Preconditions

- The gear unit is at operating temperature.
- Axis 3 is in a horizontal position.

WARNING If the oil change is carried out immediately after the robot has stopped operating, the oil temperature and the surface temperature are liable to be high and could result in burn injuries. Protective gloves must be worn.

WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

Procedure, draining oil

1. Put the robot into operation, move axis 4 to the -90° position, and then secure the robot.
2. Place a suitable receptacle ($\gg$ Fig. 10-7) under the (lower) magnetic screw plug and remove the magnetic screw plug.
It is easier to drain the oil if an M18x1.5 oil drain hose is screwed into the tapped hole of the magnetic screw plug.
3. Remove the (upper) magnetic screw plug.
4. Catch the oil in the receptacle as it drains out.

5. Measure the amount of oil drained and store or dispose of the used oil in accordance with the pertinent regulations.
6. Remove the oil drain hose if necessary.
7. Check the magnetic screw plug for deposits; take appropriate measures if necessary.
8. Clean both M18x1.5 magnetic screw plugs and check the sealing element; exchange magnetic screw plugs if damaged.
9. Insert and tighten the M18x1.5 magnetic screw plug (on the side); $M_A = 20 \text{ Nm}$.
10. Put the robot into operation, move axis 4 to the $+90^\circ$ position, and then secure the robot.

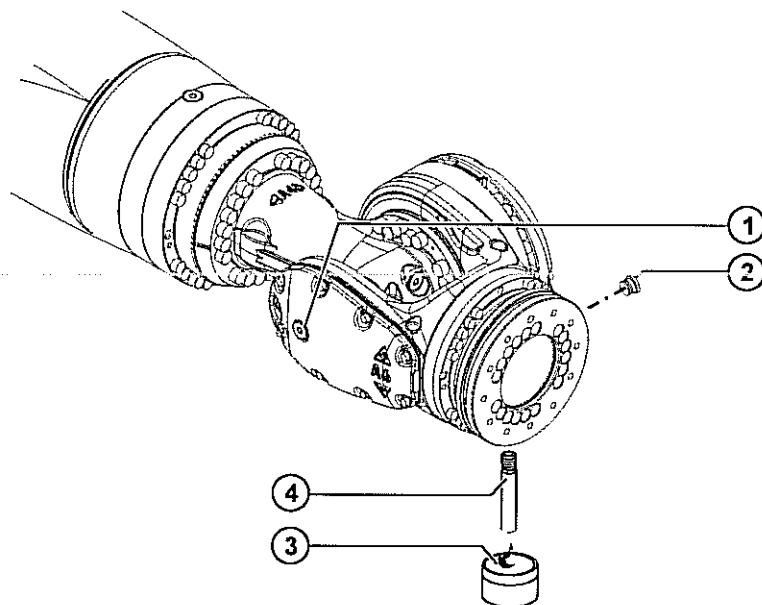


Fig. 10-7: Oil change, A6

- | | |
|------------------------------|-------------------|
| 1. Magnetic screw plug | 3. Receptacle |
| 2. Upper magnetic screw plug | 4. Oil drain hose |

**Procedure,
filling with oil**

1. Pour in, from above, the same amount of oil as was drained.
2. Insert and tighten the (upper) M18x1.5 magnetic screw plug; $M_A = 20 \text{ Nm}$.
3. Check both magnetic screw plugs for leaks.

10.8 Greasing the cable set

Preconditions

- The robot is accessible in the area of axis 1

WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.
Warn all persons concerned before starting to put it back into operation.

**Greasing the
cable set**

1. Remove 4 Allen screws with conical spring washers, and take off the cover. If necessary, interface A1 can additionally be carefully pulled back (>>> Fig. 10-8).
2. Clean the cables between the push-in module and the inlet of the hollow shaft of axis 1.
3. Apply cable grease evenly to the cables using a brush and by hand.

Protective gloves must be worn.

4. Store used grease and grease residues in accordance with the regulations or dispose of it with minimum environmental impact.
5. Mount the cover and fasten it with 4 Allen screws with conical spring washers.
6. If applicable, carefully insert interface A1 again and fasten it with 4 Allen screws and conical spring washers.

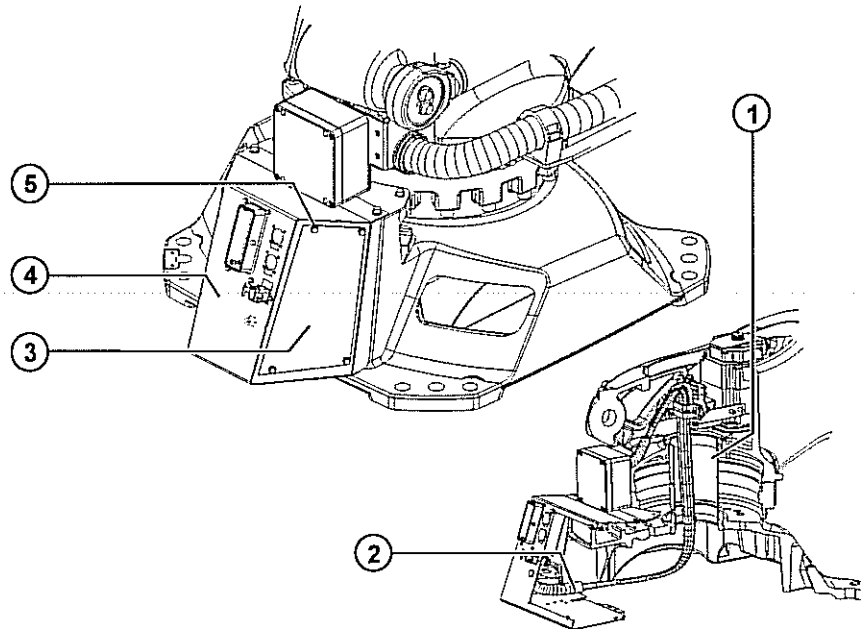


Fig. 10-8: Greasing the cable set

- | | |
|---------------------------------|----------------|
| 1 Inlet of hollow shaft | 4 Interface A1 |
| 2 Push-in module, flexible tube | 5 Allen screws |
| 3 Cover | |

10.9 Inspecting the counterbalancing system

Description The following describes those tasks which must be carried out at the intervals specified in the maintenance table.

Preconditions

- ≡ The robot is operational and can be moved at jog velocity.
- ≡ There is no hazard posed by system components or other robots.
- ≡ The robot is secured if work is being performed directly on the robot.

⚠ WARNING

When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

Inspection procedure

Activity	Required condition	Troubleshooting
Inspect hydraulic system. Move the robot and check the hydraulic oil pressure.	The pressure gauge must show the following value: Link arm in -90° position, hydraulic oil pressure: Floor-mounted robot: 182 bar	Carry out adjustment of the counterbalancing system (>>> 11.3 "Filling and adjusting the counterbalancing system" Page 124).
Check the add-on parts for damage and ensure that they are clean and do not leak.	The add-on parts must not be damaged or leak.	Clean the counterbalancing system, identify and eliminate any leaks. If necessary, exchange the counterbalancing system (>>> 12.7 "Exchanging the counterbalancing system on a floor-mounted robot" Page 145).
Check the condition of the collar.	The collar must not be damaged or fouled.	Clean or exchange the collar (>>> 12.7 "Exchanging the counterbalancing system on a floor-mounted robot" Page 145).

10.10 Cleaning the robot

Description

The robot must be cleaned in compliance with the instructions given here in order to prevent damage. These instructions only refer to the robot. System components, tools and the robot controller must be cleaned in accordance with the cleaning instructions relevant to them.

The following must be taken into consideration when using cleaning agents and carrying out cleaning work:

- Only use solvent-free, water-soluble cleaning agents.
- Do not use flammable cleaning agents.
- Do not use aggressive cleaning agents.
- Do not use steam or refrigerants for cleaning.
- Do not use high-pressure cleaners.
- It must be ensured that no cleaning agent enters electrical or mechanical system components.
- Personnel protection measures must be taken.

⚠ WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.
Warn all persons concerned before starting to put it back into operation.

Procedure

1. Shut down the robot.
2. If necessary, stop adjacent system components and lock them.
3. Remove enclosures if this is necessary in order to carry out the cleaning work.
4. Clean the robot.
5. Fully remove all cleaning agents from the robot.
6. Clean any areas of corrosion and reapply corrosion protection.

7. Remove cleaning agents and equipment from the workspace of the robot.
8. Dispose of cleaning agents properly.
9. Install any safety equipment that has been removed and check that it is functioning correctly.
10. Replace any damaged or illegible plates and covers.
11. Put back in place any enclosures that have been removed.
12. Only put fully functional robots and systems back into operation.

11 Adjustment

11.1 Counterbalancing system

Description Depending on various causes, the following work may be required on the counterbalancing system:

Cause	Activity	Description
The counterbalancing system must be depressurized	Depressurizing the counterbalancing system	(>>> 11.2 "Depressurizing the counterbalancing system" Page 123)
Incorrect pressure	Top up the gas and oil pressure	(>>> 11.3 "Filling and adjusting the counterbalancing system" Page 124)
The counterbalancing system has been drained and must be refilled	Top up the gas and oil pressure	(>>> 11.3 "Filling and adjusting the counterbalancing system" Page 124)

WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

11.2 Depressurizing the counterbalancing system

Preconditions ■ A measuring tube and collection receptacle must be available.

Procedure

1. Move the link arm into a vertical position and secure it using a crane (>>> Fig. 11-1).
The link arm must not be able to move after reducing the oil pressure.

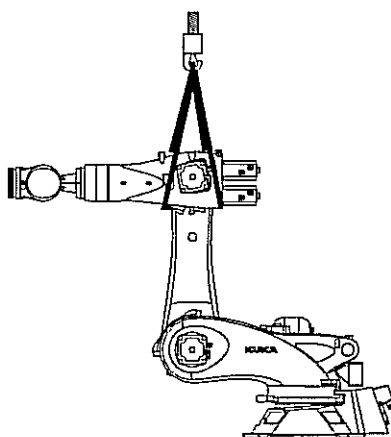


Fig. 11-1: Securing the link arm

2. Remove the screw cap and connect the tube to the vent connection (>>> Fig. 11-2).

3. Drain the hydraulic oil into a suitable receptacle.

The draining process is complete when the pressure gauge indicating the oil pressure reads zero and no more oil flows into the receptacle.

4. Store used hydraulic oil in accordance with the regulations and dispose of it with minimum environmental impact.

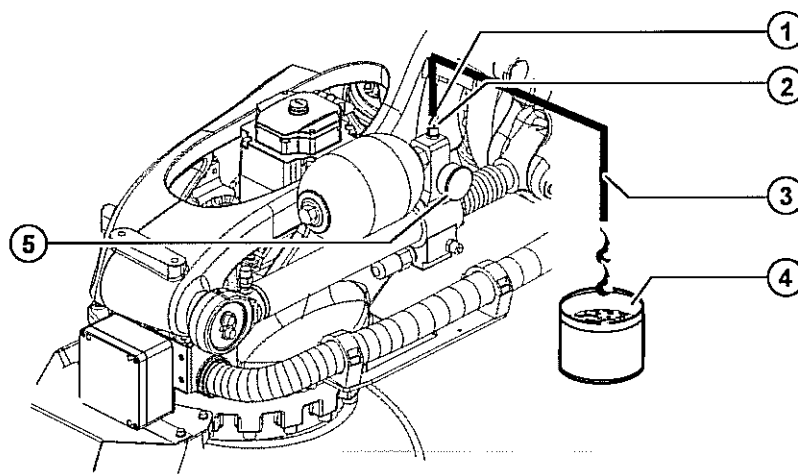


Fig. 11-2: Draining the hydraulic oil

- | | | | |
|---|-----------------|---|----------------|
| 1 | Screw cap | 4 | Receptacle |
| 2 | Vent connection | 5 | Pressure gauge |
| 3 | Tube | | |

11.3 Filling and adjusting the counterbalancing system

Preconditions

- ≡ A measuring tube and collection receptacle must be available.
- ≡ A nitrogen cylinder with pressure reducer must be available. Minimum pressure 170 bar.
- ≡ An accumulator filling device must be available.
- ≡ A hydraulic pump must be available.
- ≡ The link arm is in the -90° position (vertical).

Procedure

1. Move the link arm into a vertical position and secure it using a crane (>>> Fig. 11-3).

The link arm must not be able to move after reducing the hydraulic oil pressure.

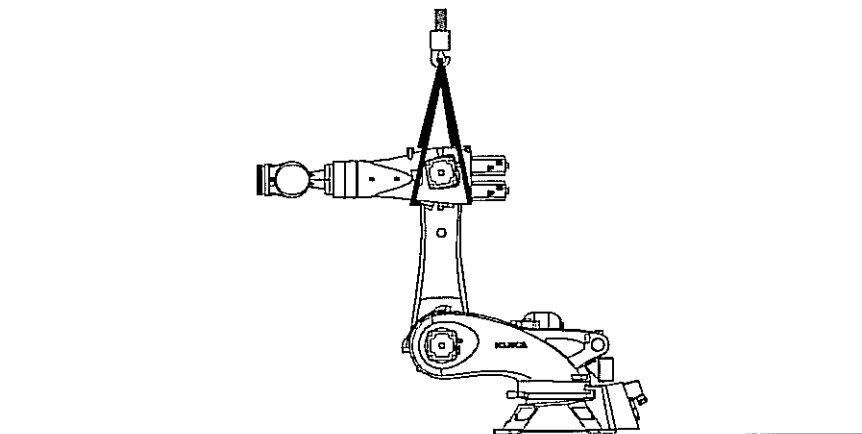


Fig. 11-3: Securing the link arm

2. Remove the screw cap and connect the tube to the vent valve (>>> Fig. 11-5).
3. Place a suitable receptacle under the tube and collect the hydraulic oil.

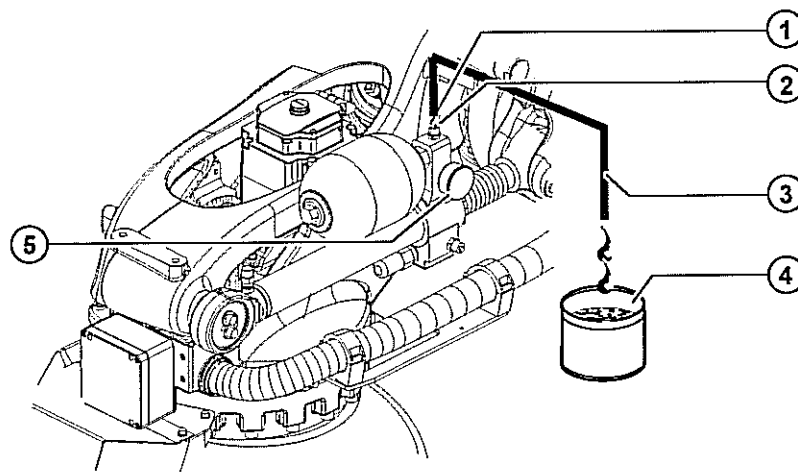


Fig. 11-4: Draining the hydraulic oil

- | | | | |
|---|------------|---|----------------|
| 1 | Screw cap | 4 | Receptacle |
| 2 | Vent valve | 5 | Pressure gauge |
| 3 | Tube | | |
4. Drain the oil until the pressure gauge reads zero.
The oil side of the diaphragm accumulator is now depressurized and can be vented during subsequent filling of the gas side.
 5. Connect the filling and testing device (accessory) for the diaphragm accumulator to a standard commercial nitrogen cylinder via the tube and a pressure reducer.
 6. Set the pressure reducer to 165 bar.

⚠ WARNING For safety reasons, the Allen screw on the accumulator may under no circumstances be unscrewed by more than a quarter of a turn without the filling and testing device being connected. The pressure in the accumulator may never be adjusted without the filling and testing device connected.

7. Remove the protective caps (>>> Fig. 11-5) from the diaphragm accumulator and unscrew the Allen screw slightly (without a torque wrench, by a quarter of a turn at the most).

No gas must be allowed to escape. If, in spite of care being taken, gas does escape (hissing sound!), the sealing ring of Allen screw must be replaced. This must only be done when the diaphragm accumulator is completely depressurized.

8. Connect the filling and testing device to the gas connection of the diaphragm accumulator. Turn the gas valve rod counterclockwise, thereby opening the gas connection via the Allen screw; a full turn is necessary after the start of pointer deflection on the pressure gauge of the filling and testing device.

The pressure gage on the counterbalancing system indicates the nitrogen pressure in the diaphragm accumulator. If the nitrogen pressure is greater than 162 bar, carry out step 9. If the nitrogen pressure is too low, carry out steps 10 to 11. Then in either case, continue with step 12.

9. Open the pressure relief valve and discharge nitrogen until the specified pressure of 162 bar is reached.

The reading on the pressure gauge must be rechecked after 2 to 3 minutes and the nitrogen pressure corrected if necessary.

10. Open the shut-off valve on the nitrogen cylinder and raise the nitrogen pressure to 165 bar.

11. Close the shut-off valve.

12. Open the pressure relief valve and discharge nitrogen until the specified pressure of 162 bar is reached.

The reading on the pressure gauge must be rechecked after 2 to 3 minutes and the nitrogen pressure corrected if necessary.

13. Turn the Allen screw clockwise by means of the gas valve rod and tighten it. Then open the pressure relief valve and discharge the remaining pressure in the tube.

14. Disconnect filling and testing device from diaphragm accumulator.

The filling and testing device may only be disconnected if the Allen screw has been tightened by means of the gas valve rod.

15. Firmly retighten the Allen screw; $M_A = 20 \text{ Nm}$.

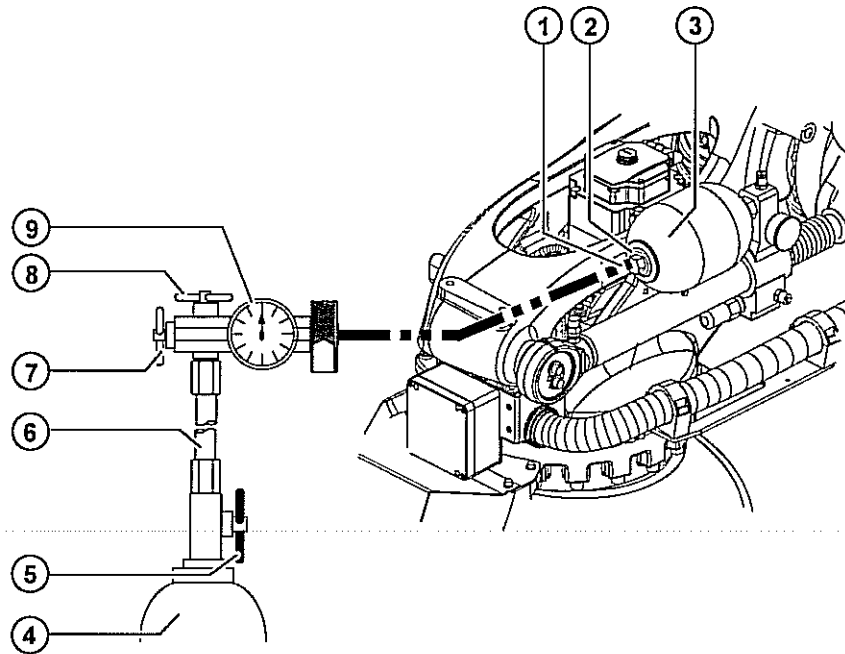


Fig. 11-5: Setting the gas pressure

- | | |
|-------------------------|-------------------------|
| 1 Protective cap | 6 Tube |
| 2 Allen screw | 7 Gas valve rod |
| 3 Diaphragm accumulator | 8 Pressure relief valve |
| 4 Nitrogen cylinder | 9 Pressure gauge |
| 5 Shut-off valve | |

16. Screw on the protective caps.
17. Release and remove the tube on the nitrogen cylinder.
18. Unscrew the screw cap on the filler neck (>>> Fig. 11-6) and connect the hydraulic tube.
The hydraulic tube must already be free from air.
19. Unscrew the screw cap on the vent connection and connect the measuring tube (unless the tube is still connected from the preceding tasks).
20. Dip the measuring tube into the liquid in the collection receptacle.
21. Put the hydraulic pump into operation and allow hydraulic oil to flow out into the collection receptacle until no more bubbles escape.
The reservoir of the hydraulic pump must only be filled with filtered Hyspin ZZ 46 (filter gage 3 μm).
22. Close the vent valve at the vent connection.
23. Continue to operate the hydraulic pump until the hydraulic oil pressure is approx. 15 bar above the specified value of 182 bar. Then lower the pump pressure to "0".
24. After approx. 10 minutes, check the hydraulic oil pressure and reduce it to 182 bar by opening the vent valve.
25. Unscrew the hydraulic tube and screw the screw cap back onto the filler neck.
26. Unscrew the measuring tube and screw the screw cap back onto the vent connection.
27. Unscrew the screw plug from the underside of the counterbalancing system and remove any leaked oil; then screw the screw plug back in and tighten with M_A 20 Nm.

28. Check the counterbalancing system for leaks.
29. Remove crane and elements securing the link arm.

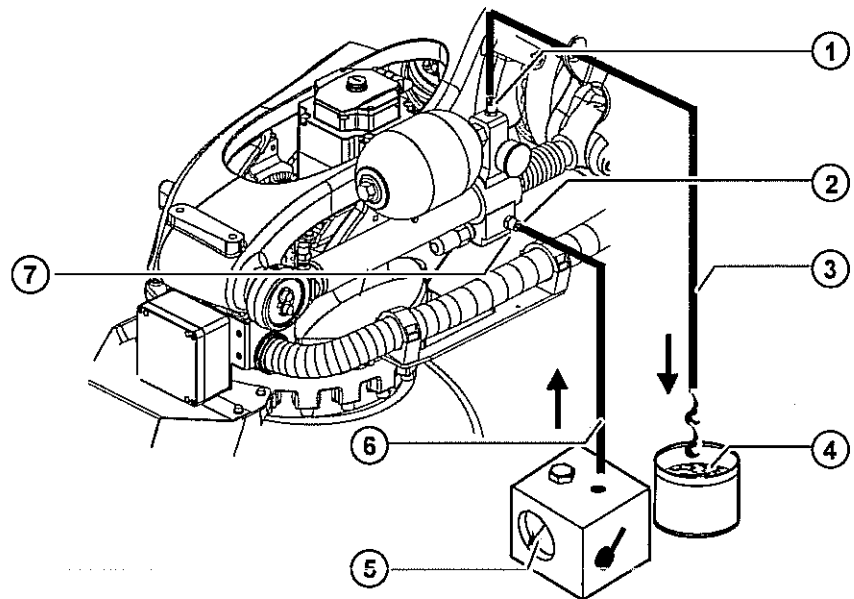


Fig. 11-6: Topping up the hydraulic oil

- | | |
|-------------------|------------------|
| 1 Vent connection | 5 Hydraulic pump |
| 2 Filler neck | 6 Hydraulic hose |
| 3 Measuring tube | 7 Screw plug |
| 4 Receptacle | |

12 Repair

NOTICE When installing components and assemblies, the fastening screws (standard, strength class 8.8) must be tightened with the specified KUKA tightening torque. Exceptions to this will be clearly marked.

The specified screw sizes and strength classes are those valid at the copy deadline. The specifications contained in the Parts Catalog are, however, always to be taken as the most up-to-date information.

Screws of strength class 10.9 and higher may only be tightened once with the rated tightening torque. When the screws are next slackened they must be replaced with new ones.

12.1 Exchanging the motor on axis 1

12.1.1 Removing the motor on axis 1

Description

WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.

WARNING If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.

WARNING When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

≡ The robot is secured against rotational motions about axis 1.

Procedure for removal

1. Release and unplug connectors XM1 and XP1 at the sockets (>>> Fig. 12-1).
2. Remove 4 Allen screws.
3. Release and lift out motor A1, being careful not to tilt it.
4. Remove the seal between the motor and the motor mount; for F variant only.
5. If the motor on A1 is not to be reinstalled, it must be protected against corrosion before being put into storage.
6. Cover the input shaft and protect it against fouling.

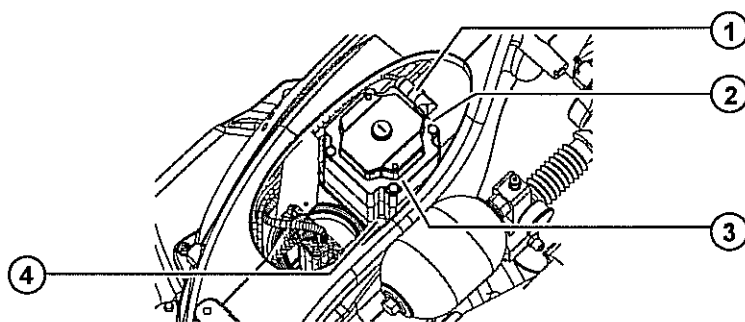


Fig. 12-1: Removing motor A1

- | | |
|-----------------|-----------------|
| 1 Connector XP1 | 3 Motor, axis 1 |
| 2 Connector XM1 | 4 Allen screws |

12.1.2 Installing the motor on axis 1

Description



WARNING

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.



NOTICE

When installing the motor, it must be ensured that the toothing of the motor and gear unit is not damaged.

Procedure for installation

1. Remove all protective coatings and oil from new motor A1, if applicable (>>> Fig. 12-2).
2. Clean the toothing of the motor and the gear unit before installation and apply a thin but continuous coat of Microlube GL 261 grease.
3. Clean the mounting surface of motor A1 on the motor mount.
4. Check the condition of the O-ring on the motor shaft.
5. Fit seal on motor mount; F variant only.
6. Position sockets XM1 and XP1 as shown in the illustration.
7. Insert motor A1; do not tilt while it is being installed.



Insertion of motor can be facilitated by turning it gently about its rotational axis.

8. Insert 4 M12x25-8.8 Allen screws.
9. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 78 Nm.
10. Plug connectors XM1 and XP1 into the sockets.
11. Remove safeguards against the robot turning about axis 1.
12. Carry out mastering of axis 1.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

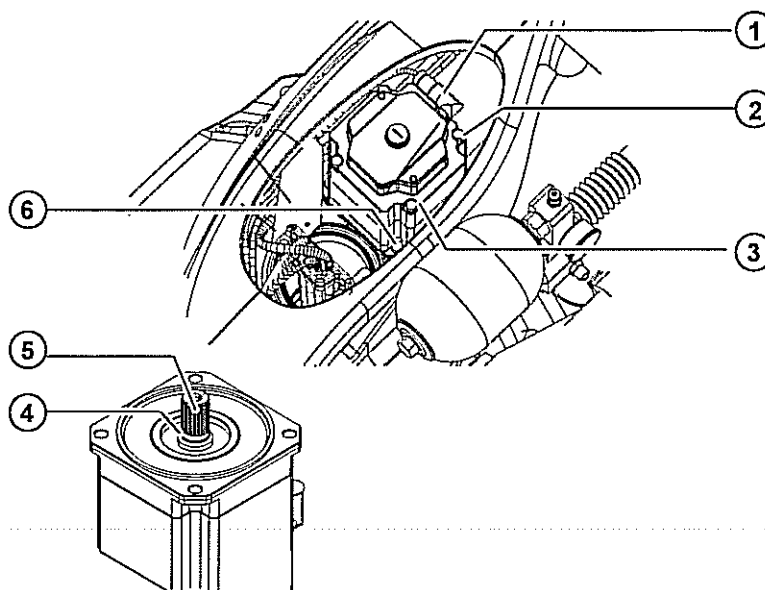


Fig. 12-2: Installing motor A1

- | | | | |
|---|---------------|---|--------------|
| 1 | Connector XP1 | 4 | O-ring |
| 2 | Connector XM1 | 5 | Toothing |
| 3 | Motor A1 | 6 | Allen screws |

12.2 Exchanging the motor on axis 2

12.2.1 Removing the motor on axis 2

Description

WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button. Warn all persons concerned before starting to put it back into operation.

WARNING If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.

WARNING When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

- ▣ The robot is secured against motion about axis 2.

Procedure for removal

1. Secure the link arm using a rope sling (>>> Fig. 12-3).
2. Raise the rope sling until it is ensured that the link arm cannot move after removal of the motor.

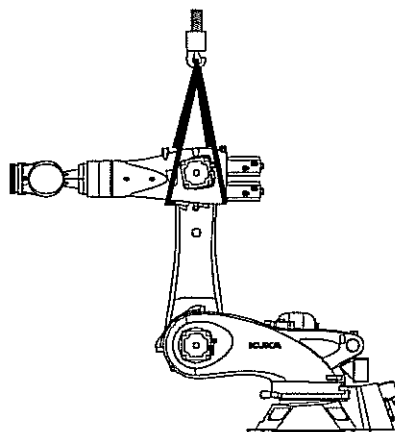


Fig. 12-3: Securing the link arm

3. Release and unplug connectors XM2 and XP2 at the sockets (>>> Fig. 12-4).
4. Place the rope sling around motor A2 and raise it using the crane until the weight of motor A2 is supported by the rope sling.
5. Remove 4 Allen screws.
6. Release and pull out motor A2, being careful not to tilt it.
7. Remove the seal between the motor and the rotating column; for F variant only.
8. If the motor on A2 is not to be reinstalled, it must be set down and protected against corrosion before being put into storage.

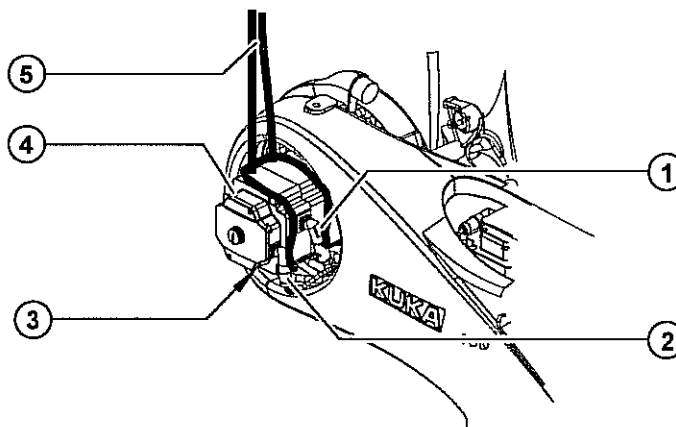


Fig. 12-4: Removing motor A2

- | | | | |
|---|---------------|---|------------|
| 1 | Connector XM2 | 4 | Motor A2 |
| 2 | Connector XP2 | 5 | Rope sling |
| 3 | Allen screws | | |

12.2.2 Installing the motor on axis 2

Description



When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

NOTICE

When installing the motor, it must be ensured that the tothing of the motor and gear unit is not damaged.

Preconditions

- The robot is secured against rotational motions about axis 2.

Procedure for installation

1. Remove all protective coatings and oil from new motor A 2 (>>> Fig. 12-5).
2. Clean the tothing of motor A2 and gear unit before installation and apply a thin but continuous coat of Microlube GL 261 grease.
3. Clean the mounting surface of motor A2 on the gear unit.
4. Check the condition of the O-ring on the motor shaft.
5. Position sockets XM2 and XP2 as shown in the diagram.
6. With the rope sling, pick up and insert motor A2, together with the seal (only F variant), being careful not to tilt it.



Insertion of motor can be facilitated by turning it gently about its rotational axis.

7. Insert 4 M12x25-8.8 Allen screws.
8. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 78 Nm.
9. Slacken and remove the rope sling.
10. Plug connectors XM2 and XP2 into the sockets.
11. Remove elements securing the link arm.
12. Carry out mastering of axis 2.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

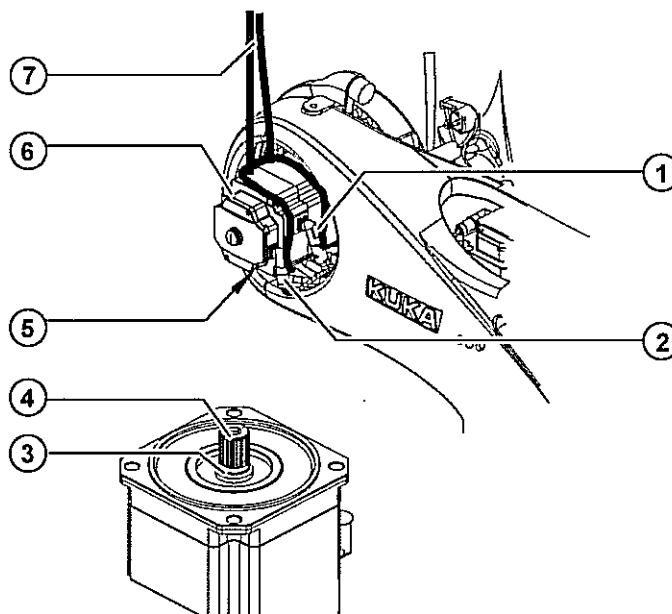


Fig. 12-5: Installing motor A2

- | | | | |
|---|---------------|---|--------------|
| 1 | Connector XM2 | 5 | Allen screws |
| 2 | Connector XP2 | 6 | Motor A2 |

- 3 O-ring
- 4 Toothing

- 7 Rope sling

12.3 Exchanging the motor on axis 3

12.3.1 Removing the motor on axis 3

Description

WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button. Warn all persons concerned before starting to put it back into operation.

WARNING If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.

WARNING When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

- ≡ The robot is secured against motion about axis 3.

Procedure for removal

1. Secure the arm using a rope sling (>>> Fig. 12-6).
2. Raise the rope sling until it is ensured that the arm cannot move after removal of the motor.

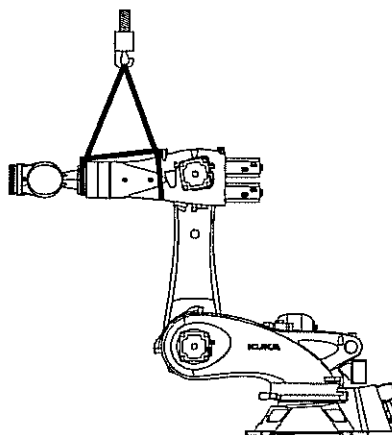


Fig. 12-6: Securing the arm

3. Release and unplug connectors XM3 and XP3 at the sockets (>>> Fig. 12-7).
4. Place the rope sling around motor A3 and raise it using the crane until the weight of motor A3 is supported by the rope sling.
5. Remove 4 Allen screws.
6. Release and pull out motor A3, being careful not to tilt it.
7. Remove the seal between the motor and the arm; for F variant only.
8. If the motor on A3 is not to be reinstalled, it must be set down and protected against corrosion before being put into storage.

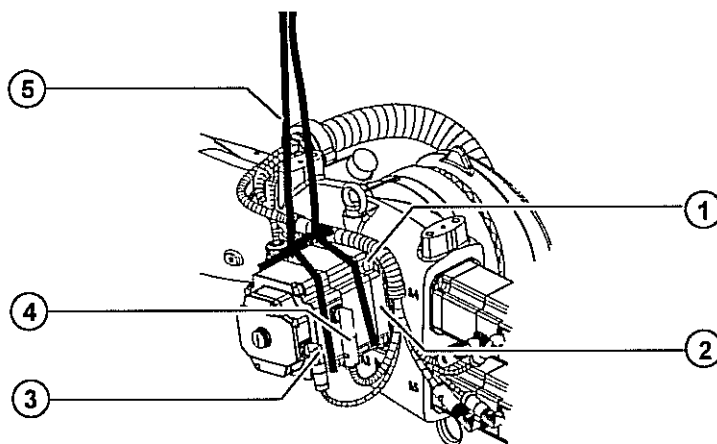


Fig. 12-7: Removing motor A3

- | | |
|-----------------|-----------------|
| 1 Allen screws | 4 Connector XM3 |
| 2 Motor A3 | 5 Rope sling |
| 3 Connector XP3 | |

12.3.2 Installing the motor on axis 3

Description

WARNING When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

NOTICE When installing the motor, it must be ensured that the toothings of the motor and gear unit is not damaged.

Preconditions

- The robot is secured to prevent rotational motions about axis 3 once the motor has been removed.

Procedure for installation

1. Remove all protective coatings and oil from the new motor A3.
2. Clean the toothings of motor A3 and gear unit before installation and apply a thin but continuous coat of Microlube GL 261 grease (>>> Fig. 12-8).
3. Clean the mounting surface for the motor A3 on the arm.
4. Check the condition of the O-ring on the motor shaft.
5. Position sockets XM3 and XP3 as shown in the illustration.
6. With the rope sling, pick up and insert motor A3, together with the seal (only F variant), being careful not to tilt it.

i Insertion of motor can be facilitated by turning it gently about its rotational axis.

7. Insert 4 M12x35-8.8 Allen screws.
8. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 78 Nm.
9. Slacken and remove the rope sling.
10. Plug connectors XM3 and XP3 into the sockets.
11. Remove elements securing the arm.
12. Carry out mastering of axis 3.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

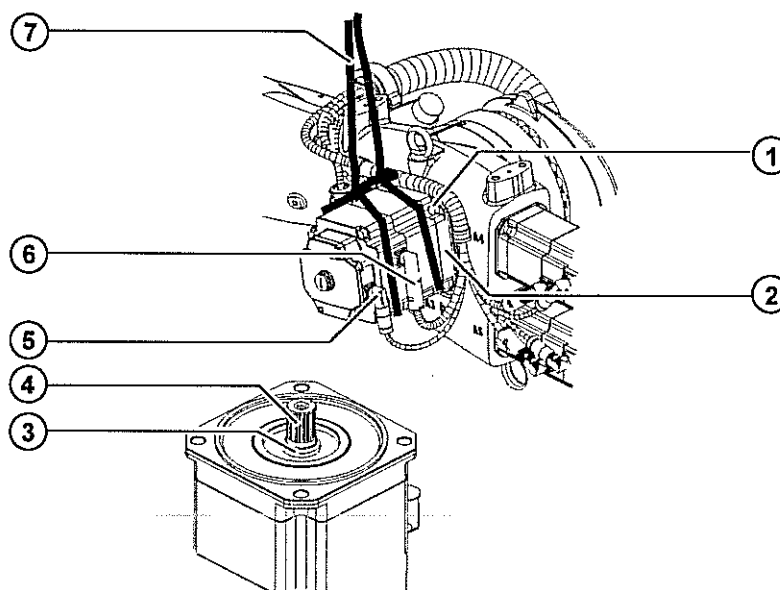


Fig. 12-8: Installing motor A3

- | | | | |
|---|--------------|---|---------------|
| 1 | Allen screws | 5 | Connector XP3 |
| 2 | Motor A3 | 6 | Connector XM3 |
| 3 | O-ring | 7 | Rope sling |
| 4 | Toothing | | |

12.4 Exchanging the motor on axis 4

12.4.1 Removing the motor on axis 4

Description

The following describes the removal of motor A4 for floor-mounted robots. The description also applies to ceiling-mounted robots (C variant). If the ceiling-mounted robot is currently installed on the ceiling, the procedure is to be applied analogously.



WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.



WARNING If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.



WARNING When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

- Tools are dismantled or secured so that they cannot move once the motor has been removed.
- The arm is positioned horizontally.

Procedure for removal

1. Release and unplug connectors XM4 and XP4 at the sockets (>>> Fig. 12-9).
2. Place the rope sling around motor A4 and raise it using the crane until the weight of motor A4 is supported by the rope sling.
3. Remove 4 Allen screws.
4. Release motor A4 and pull it out together with the connecting shaft, being careful not to tilt it.
5. Remove the seal between the motor and the arm; for F variant only.
6. Set down motor A4.

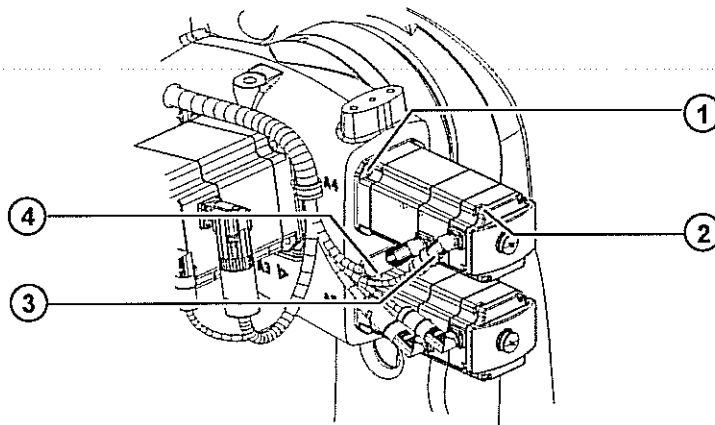


Fig. 12-9: Removing motor A4

- | | |
|----------------|-----------------|
| 1 Allen screws | 3 Connector XP4 |
| 2 Motor A4 | 4 Connector XM4 |

The following two work steps are only to be carried out if motor A4 is not to be reinstalled.

7. Slacken both setscrews (>>> Fig. 12-10) until the connecting shaft can be pulled off the toothing, and pull off the connecting shaft.
8. Remove the Allen screw from the shaft stub and take off the axial retainer.
9. If the motor on A4 is not to be reinstalled, it must be protected against corrosion before being put into storage.

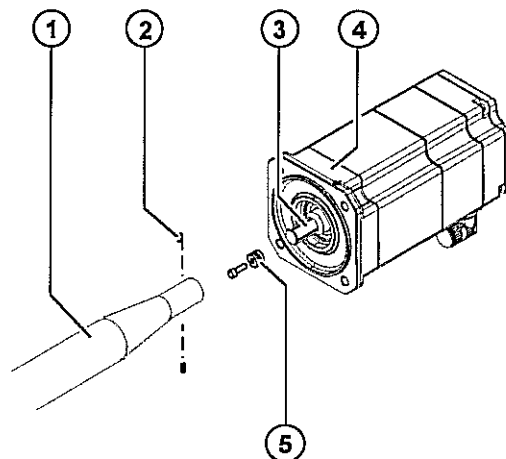


Fig. 12-10: Motor with connecting shaft

- | | | | |
|---|------------------|---|----------------|
| 1 | Connecting shaft | 4 | Motor A4 |
| 2 | Setscrew | 5 | Axial retainer |
| 3 | Shaft stub | | |

12.4.2 Installing the motor on axis 4

Description

The following describes the installation of motor A4 for floor-mounted robots. The description also applies to ceiling-mounted robots (C variant). If the ceiling-mounted robot is currently installed on the ceiling, the procedure is to be applied analogously.



WARNING

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.



NOTICE

When installing the motor, it must be ensured that the toothings of the motor and connecting shaft is not damaged.

Preconditions

- ⇒ The robot is secured to prevent rotational motions about axis 4 once the motor has been removed.

Procedure for installation

1. Remove all protective coatings and oil from the new motor A4 (>>> Fig. 12-11).
2. Mount the axial retainer and fasten it with an M5x20-10.9 Allen screw.
3. Clean the toothings on motor A4 and on the connecting shaft before installation and apply a thin but continuous coat of Microlube GL 261 grease.
4. Fit the connecting shaft onto motor A4.
5. Clean the M4x8 setscrews on both sides, apply Drei Bond 1342 locking agent and insert them.
The setscrews must engage with the groove in the axial retainer.
6. Evenly tighten the setscrews; $M_A = 2.8 \text{ Nm}$.

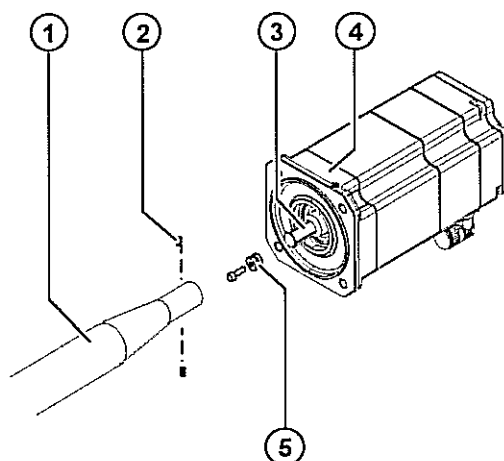


Fig. 12-11: Motor with connecting shaft

- | | | | |
|---|------------------|---|----------------|
| 1 | Connecting shaft | 4 | Motor A5 |
| 2 | Setscrew | 5 | Axial retainer |
| 3 | Shaft stub | | |

7. Clean the mounting surface (>>> Fig. 12-12) for motor A4 on the arm.
8. Position connectors XM4 and XP4 so that they are located on the left-hand side after the motor has been inserted into the arm.
9. Lift motor A4 with a rope sling and insert it into the arm together with the seal (F variant only), being careful not to tilt it and ensuring that the connecting shafts (toothing) are correctly engaged.



Insertion of motor can be facilitated by turning it gently about its rotational axis.

10. Insert 4 M8x25-8.8 Allen screws.
11. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 23 Nm.
12. Slacken and remove the rope sling.
13. Plug connectors XM4 and XP4 into the sockets.
14. Remove elements securing the tooling.
15. Carry out mastering of axis 4.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

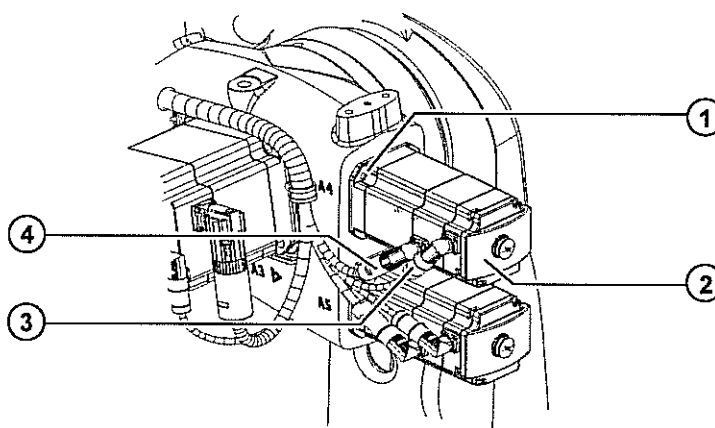


Fig. 12-12: Installing motor A4

- | | | | |
|---|--------------|---|---------------|
| 1 | Allen screws | 3 | Connector XP4 |
| 2 | Motor A4 | 4 | Connector XM4 |

12.5 Exchanging the motor on axis 5

12.5.1 Removing the motor on axis 5

Description

The following describes the removal of motor A5 for floor-mounted robots. The description also applies to ceiling-mounted robots (C variant). If the ceiling-mounted robot is currently installed on the ceiling, the procedure is to be applied analogously.



WARNING

Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button.

Warn all persons concerned before starting to put it back into operation.



WARNING

If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.



WARNING

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

- Tools are dismantled or secured so that they cannot move once the motor has been removed.
- The arm is positioned horizontally.

Procedure for removal

1. Release and unplug connectors XM5 and XP5 at the sockets (>>> Fig. 12-13).
2. Place the rope sling around motor A5 and raise it using the crane until the weight of motor A5 is supported by the rope sling.
3. Remove 4 Allen screws.

4. Release motor A5 and pull it out together with the connecting shaft, being careful not to tilt it.
5. Remove the seal between the motor and the arm; for F variant only.
6. Set down motor A5.

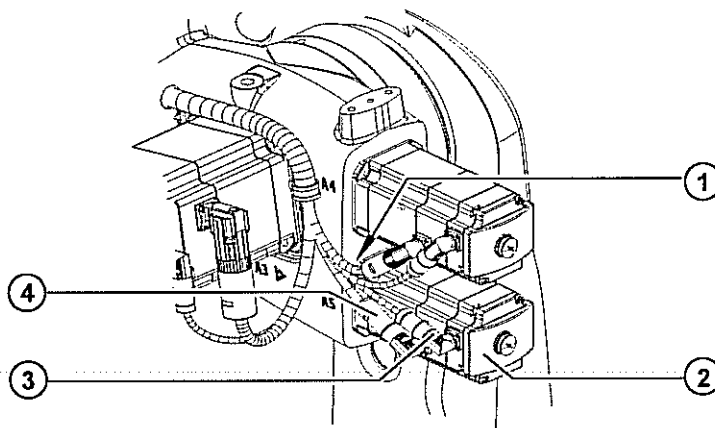


Fig. 12-13: Removal of motor A5

- | | |
|----------------|-----------------|
| 1 Allen screws | 3 Connector XP5 |
| 2 Motor A5 | 4 Connector XM5 |

The following two work steps are only to be carried out if motor A5 is not to be reinstalled.

7. Slacken both setscrews (>>> Fig. 12-14) until the connecting shaft can be pulled off the toothing, and pull off the connecting shaft.
8. Remove the Allen screw from the shaft stub and take off the axial retainer.
9. If motor A5 is not to be reinstalled, it must be protected against corrosion before being put into storage.

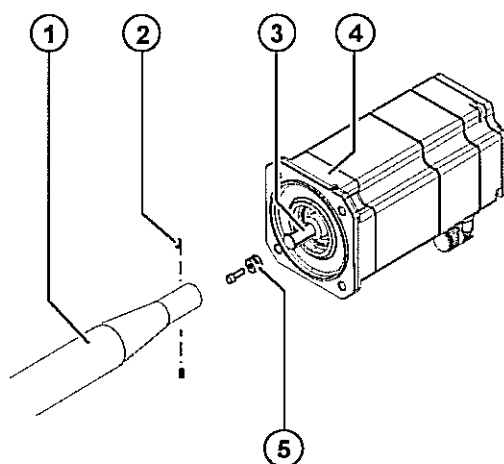


Fig. 12-14: Motor with connecting shaft

- | | |
|--------------------|------------------|
| 1 Connecting shaft | 4 Motor A5 |
| 2 Setscrew | 5 Axial retainer |
| 3 Toothing | |

12.5.2 Installing the motor on axis 5

Description

The following describes the installation of motor A5 for floor-mounted robots. The description also applies to ceiling-mounted robots (C variant). If the ceiling-mounted robot is currently installed on the ceiling, the procedure is to be applied analogously.



WARNING

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.



NOTICE

When installing the motor, it must be ensured that the toothing of the motor and connecting shaft is not damaged.

Preconditions

- ≡ The robot is secured to prevent rotational motions about axis 5 once the motor has been removed.

Procedure for installation

1. Remove all protective coatings and oil from the new motor A5 (>>> Fig. 12-15).
2. Mount the axial retainer and fasten it with an M5x20-10.9 Allen screw.
3. Clean the toothing on motor A5 and on the connecting shaft before installation and apply a thin but continuous coat of Microlube GL 261 grease.
4. Fit the connecting shaft onto motor A5.
5. Clean the M4x8 setscrews on both sides, apply Drei Bond 1342 locking agent and insert them.
The setscrews must engage with the groove in the axial retainer.
6. Evenly tighten the setscrews; $M_A = 2.8 \text{ Nm}$.

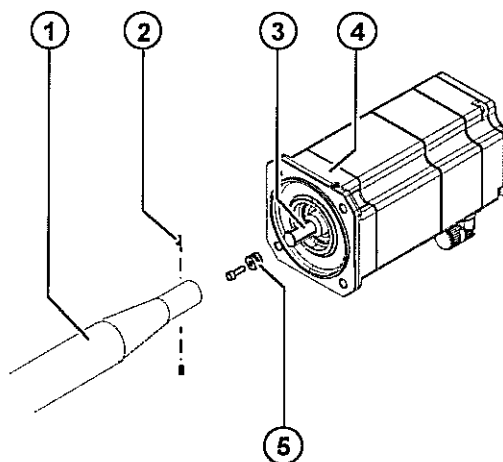


Fig. 12-15: Motor with connecting shaft

- | | | | |
|---|------------------|---|----------------|
| 1 | Connecting shaft | 4 | Motor A5 |
| 2 | Setscrew | 5 | Axial retainer |
| 3 | Shaft stub | | |

7. Clean the mounting surface for motor A5 on the arm (>>> Fig. 12-13).
8. Position connectors XM5 and XP5 so that they are located on the left-hand side after the motor has been inserted into the arm.
9. Lift motor A5 with a rope sling and insert it into the arm together with the seal (F variant only), being careful not to tilt it and ensuring that the connecting shafts (toothing) are correctly engaged in the in-line wrist.



Insertion of motor can be facilitated by turning it gently about its rotational axis.

The rope sling can only be used if motor A4 is not installed. Otherwise, use suitable handling equipment to bring motor A5 to the site of installation and insert it.

10. Insert 4 M8x25-8.8 Allen screws.
11. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 23 Nm.
12. If applicable, slacken and remove the rope sling.
13. Plug connectors XM5 and XP5 into the sockets.
14. Remove elements securing the tooling.
15. Carry out mastering of axis 5.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

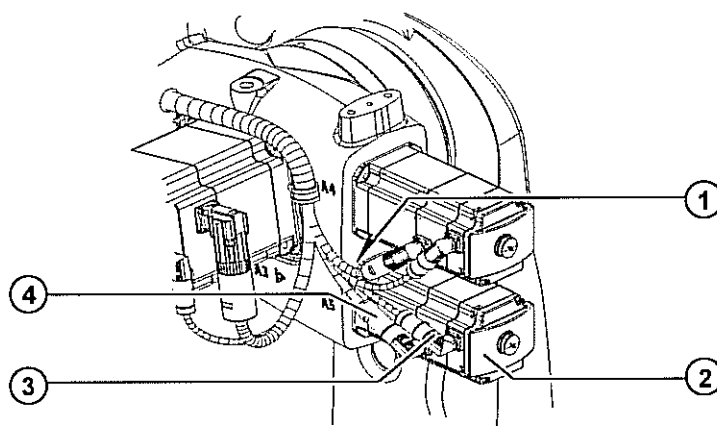


Fig. 12-16: Installation of motor A5

- | | |
|----------------|-----------------|
| 1 Allen screws | 3 Connector XP5 |
| 2 Motor A5 | 4 Connector XM5 |

12.6 Exchanging the motor on axis 6

12.6.1 Removing the motor on axis 6

Description



WARNING Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot, the robot must be secured by activating the EMERGENCY STOP button. Warn all persons concerned before starting to put it back into operation.



WARNING If the motor change is carried out immediately after the robot has stopped operating, the surface temperatures of the motor are liable to be high and could result in burn injuries. Protective gloves must be worn.

**WARNING**

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

Preconditions

- The in-line wrist is removed.

Procedure for removal

1. Remove 4 Allen screws (>>> Fig. 12-17).
2. Release motor A6 and pull it out of the in-line wrist, being careful not to tilt it.
3. If the motor on A6 is not to be reinstalled, it must be set down and protected against corrosion before being put into storage.

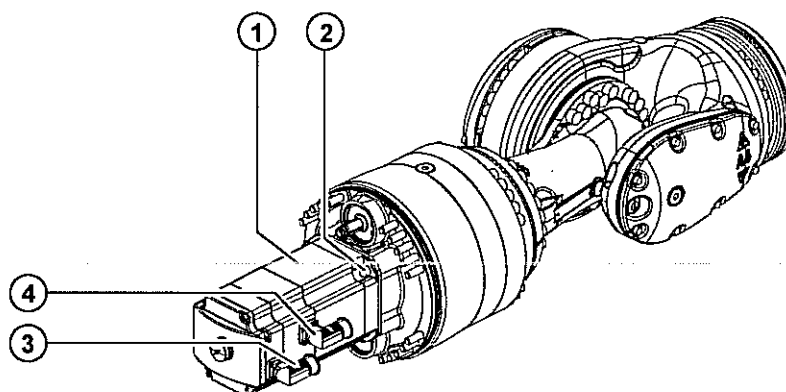


Fig. 12-17: Removing motor A6

- | | |
|----------------|-----------------|
| 1 Motor A6 | 3 Connector XP6 |
| 2 Allen screws | 4 Connector XM6 |

12.6.2 Installing the motor on axis 6

Description**WARNING**

When removing or installing the motor, care must be taken to avoid injury to hands by crushing. Protective gloves must be worn.

**NOTICE**

When installing the motor, it must be ensured that the toothing of the motor and gear unit is not damaged.

Procedure for installation

1. Remove all protective coatings and oil from the new motor A6.
2. Clean the toothing on motor A6 and in the gear unit of the in-line wrist before installation and apply a thin but continuous coat of Microlube GL 261 grease (>>> Fig. 12-18).
3. Clean the mounting surface for motor A6 on the in-line wrist.
4. Position connectors XM5 and XP5 so that they are located on the right-hand side after the motor has been inserted into the in-line wrist.
5. Insert motor A6 into the in-line wrist, taking care not to tilt it.

**Information**

Insertion of motor can be facilitated by turning it gently about its rotational axis.

6. Insert 4 M8x25-8.8 Allen screws.

7. Tighten 4 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 23 Nm.
8. Install the in-line wrist (>>> 12.8.2 "Installing the in-line wrist" Page 153).

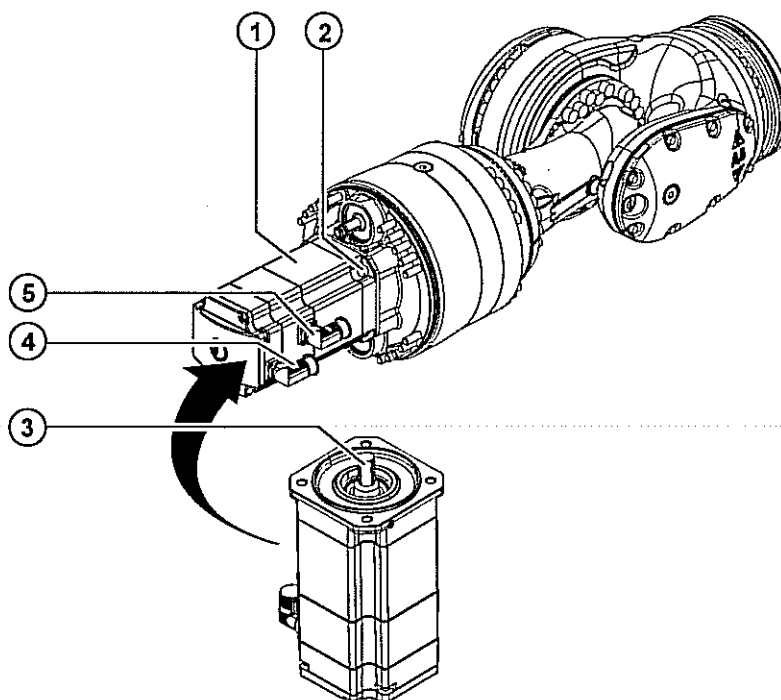


Fig. 12-18: Removing motor A6

- | | | | |
|---|--------------|---|---------------|
| 1 | Motor A6 | 4 | Connector XP6 |
| 2 | Allen screws | 5 | Connector XM6 |
| 3 | Toothing | | |

12.7 Exchanging the counterbalancing system on a floor-mounted robot

12.7.1 Removing the counterbalancing system

⚠ WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

⚠ WARNING

When removing or installing the counterbalancing system, care must be taken to avoid injury to arms, hands and fingers by crushing. Wear gloves and secure the counterbalancing system so that it cannot fall down or move unexpectedly. The counterbalancing system weighs approx. 40 kg. The counterbalancing system is pressurized. Particular caution must therefore be exercised and special knowledge put to effect when any work is performed on this system. Any improper handling constitutes a danger to life and limb.

Preconditions

- It must be possible to move the robot about axis 2.
- The locking pin (00-194-717) for the piston must be available.
- The pin locator (00-190-253) must be available.
- The robot must be correctly bolted to the floor.
- Any items of equipment that are likely to impede the removal work have been removed.

Procedure for removal

1. Remove the screw plugs (>>> Fig. 12-19).
2. Put the robot into operation and move the link arm in the plus direction (approx. +85° position) until the locking pin can be inserted.
3. Remove the screw plug and screw in the locking pin. The wrench flats lie parallel to the counterbalancing system. It must be possible to turn the locking pin by hand.
4. Carefully move the link arm in the minus direction until the piston of the counterbalancing system rests lightly on the locking pin. The locking pin then cannot be turned any further.

⚠ CAUTION

If the link arm is moved any further in the minus direction with the locking pin screwed in, this will result in damage to the counterbalancing system, link arm or rotating column.

5. Secure the robot by pressing the E-STOP device.
6. Secure the counterbalancing system with a rope sling and a crane and move the crane until the weight is supported by the rope sling.
7. Remove 4 Allen screws and conical spring washers, and take off the retaining plate.

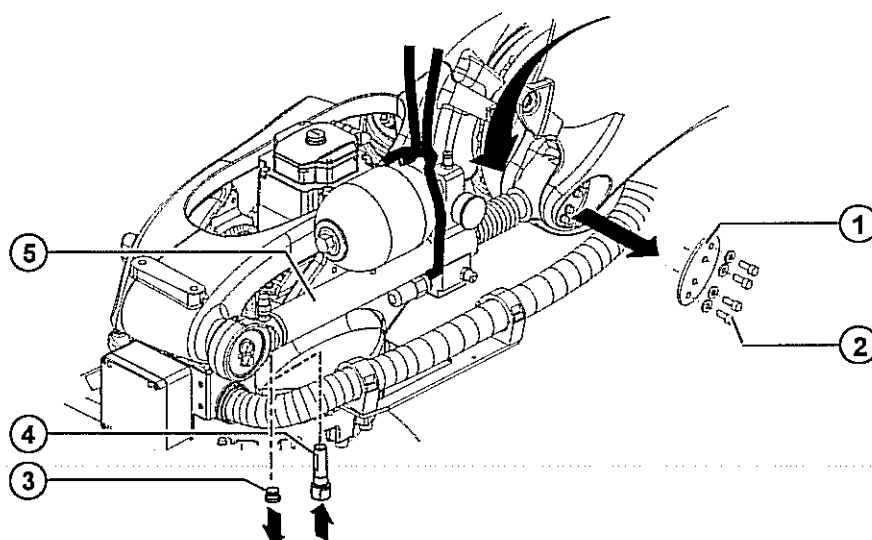


Fig. 12-19: Removing the counterbalancing system: locking pin

- | | |
|-------------------|---------------------------|
| 1 Retaining plate | 4 Locking pin |
| 2 Allen screws | 5 Counterbalancing system |
| 3 Screw plug | |

8. Secure link arm using a rope sling and crane (>>> Fig. 12-20).

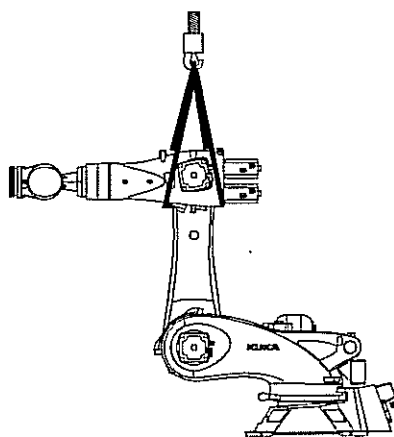


Fig. 12-20: Securing the link arm

9. Remove 2 Allen screws and lock washers, and take the cover off the rotating column (>>> Fig. 12-21).

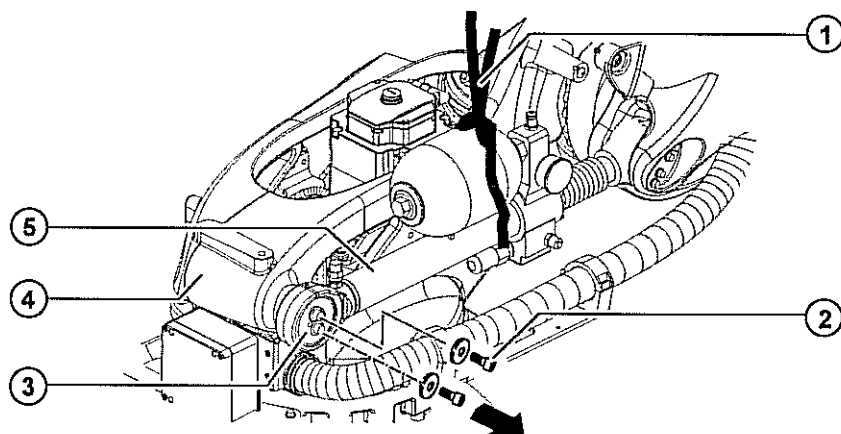


Fig. 12-21: Removing the counterbalancing system: rotating column

- | | |
|----------------|-------------------|
| 1 Rope sling | 3 Cover |
| 2 Allen screws | 4 Rotating column |

10. Insert the pin locator on the right-hand side between the articulated head and the link arm (>>> Fig. 12-22).
11. Pull the pin out of the link arm using an M16 pin extractor.
The pin is out of the precision fit area when it has been pulled out approx. 25 mm.
12. Put the robot into operation and move the link arm carefully in the plus direction until the articulated head is free. When moving the link arm, move the crane and rope sling at the same time, so that the weight of the arm is supported by the crane.
13. Secure the robot by pressing the E-STOP device.
14. Swivel the counterbalancing system up and out of the link arm, moving the crane and rope sling at the same time.
15. Take off the pin locator, thrust ring and spacer ring that are now loose.

CAUTION

When forcing the counterbalancing system off the rotating column, an unfavorable position of the center of gravity may cause the counterbalancing system to move unexpectedly. To avoid injury and damage, the tension and position of the rope must be adjusted as necessary.

16. Force the counterbalancing system off the pin in the rotating column in the direction of the arrow.
While forcing off the counterbalancing system, check the rope tension and if necessary correct it to prevent the components from being tilted.
17. Continue raising the counterbalancing system with the crane and set it down on a suitable support.
18. If the counterbalancing system is not to be reinstalled, it must be protected against corrosion before being put into storage.

If a new counterbalancing system is not being installed immediately, the robot can be moved into a safe position and the rope securing the link arm can be removed. The robot may only be moved again in order to install the new counterbalancing system.

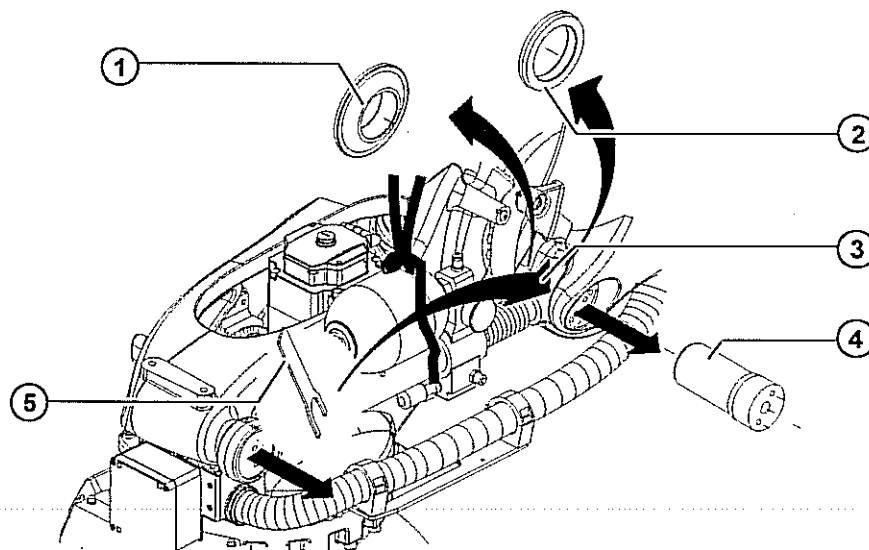


Fig. 12-22: Removing the counterbalancing system: pin

- | | |
|--------------------|---------------|
| 1 Thrust ring | 4 Pin |
| 2 Spacer ring | 5 Pin locator |
| 3 Articulated head | |

12.7.2 Installing the counterbalancing system

Description

⚠ WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

⚠ WARNING When removing or installing the counterbalancing system, care must be taken to avoid injury to arms, hands and fingers by crushing. Wear gloves and secure the counterbalancing system so that it cannot fall down or move unexpectedly. The counterbalancing system weighs approx. 40 kg. The counterbalancing system is pressurized. Particular caution must therefore be exercised and special knowledge put to effect when any work is performed on this system. Any improper handling constitutes a danger to life and limb.

Preconditions

- ≡ It must be possible to move the robot about axis 2.
- ≡ The robot must be correctly bolted to the floor.
- ≡ The counterbalancing system is correctly filled.
- ≡ The device (00-190-157) must be available.
- ≡ Any items of equipment that are likely to impede the installation work have been removed.

Procedure for installation

1. Remove all protective coatings and oil from the counterbalancing system and check that no part of it is missing.
2. If necessary, put the robot into operation and move the link arm into approximately the +85° position.
3. Secure the robot by pressing the E-STOP device.
4. Secure link arm using a rope sling and crane (>>> Fig. 12-23).

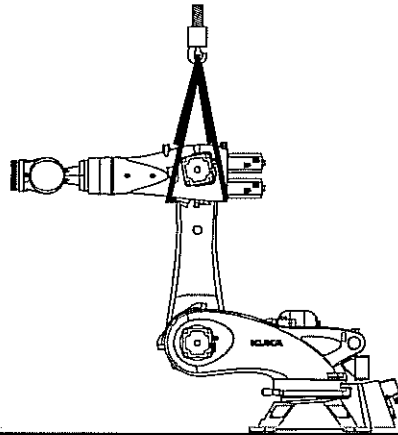


Fig. 12-23: Securing the link arm

5. Lift the counterbalancing system with a rope sling and bring it to the site of installation (>>> Fig. 12-24).
6. Mount the counterbalancing system sideways on the pin in the rotating column, and align.
7. If necessary, adjust the rope tension.
8. Mount the cover and fasten with two M12x30-10.9 Allen screws and conical spring washers.
9. Tighten the Allen screws with a torque wrench; $M_A = 104 \text{ Nm}$.

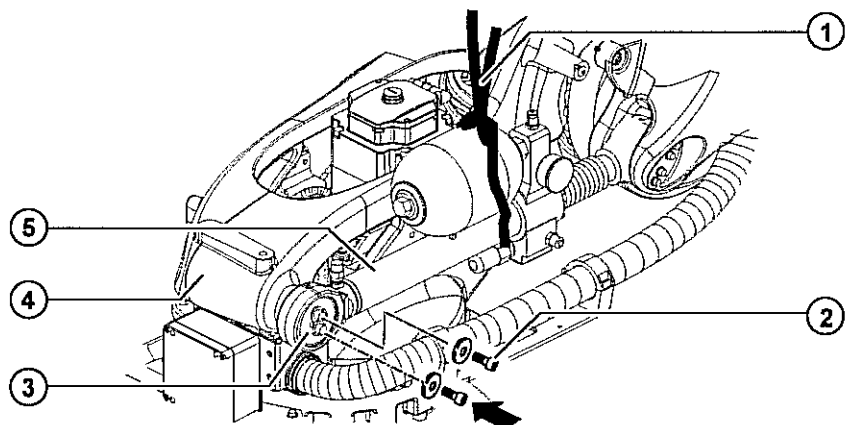


Fig. 12-24: Installing the counterbalancing system: rotating column

- | | |
|---------------|---------------------------|
| 1 Rope sling | 3 Cover |
| 2 Allen screw | 4 Counterbalancing system |

10. Put the robot into operation.
11. Move the link arm until the counterbalancing system can be inserted into the link arm. At the same time, move the element securing the link arm accordingly (>>> Fig. 12-25).

12. Lower the counterbalancing system, insert the articulated head with the thrust ring and spacer ring into the link arm, and align.
13. Move the link arm and counterbalancing system until the holes are aligned.
14. Insert the pin using the device (00-190-157).
15. Mount the retaining plate and fasten it with 4 M8x20-10.9 Allen screws and conical spring washers.
16. Tighten the 4 Allen screws with a torque wrench; $M_A = 31 \text{ Nm}$.
17. Remove the rope sling from the counterbalancing system and the link arm.

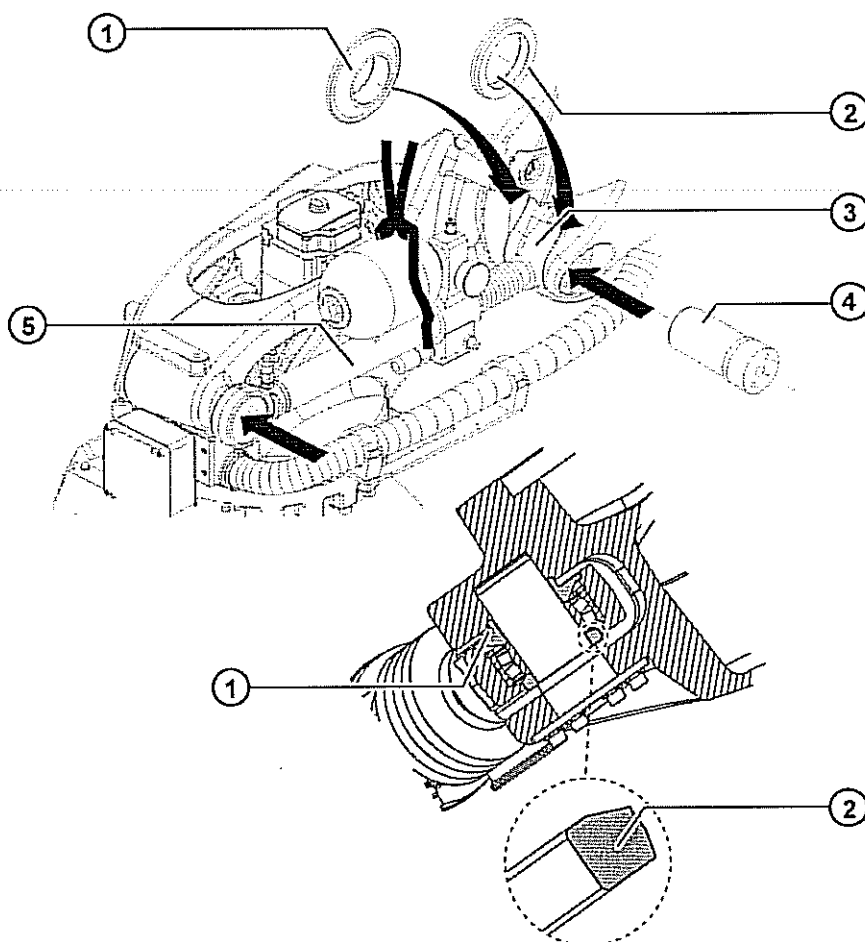


Fig. 12-25: Installing the counterbalancing system: pin

- | | |
|--------------------|---------------------------|
| 1 Thrust ring | 4 Pin |
| 2 Spacer ring | 5 Counterbalancing system |
| 3 Articulated head | |

18. Put the robot into operation.
19. Move the link arm in the plus direction until the locking pin is released, and unscrew the locking pin (>>> Fig. 12-26).

⚠ CAUTION

If the link arm is moved any further in the minus direction with the locking pin screwed in, this will result in damage to the counterbalancing system, link arm or rotating column.

20. Secure the robot by pressing the E-STOP device.
21. Insert and tighten the M18x1.5 screw plugs; $M_A = 20 \text{ Nm}$.

22. Check the pressure on the counterbalancing system (>>> 11.3 "Filling and adjusting the counterbalancing system" Page 124).

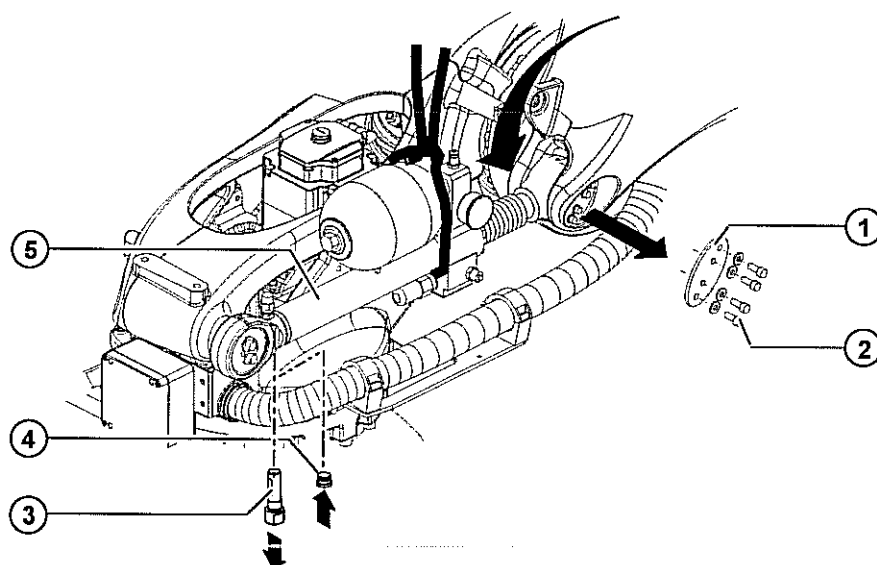


Fig. 12-26: Installing the counterbalancing system: link arm

- | | |
|-------------------|---------------------------|
| 1 Retaining plate | 4 Screw plug |
| 2 Allen screws | 5 Counterbalancing system |
| 3 Locking pin | |

12.8 Exchanging the in-line wrist

12.8.1 Removing the in-line wrist

Description

All of the in-line wrist variants are removed in the same way, irrespective of the payload or arm length. In the following description, only the removal of the IW 270/300 in-line wrist will be described.

WARNING When work is performed on this system, live parts and unintentional robot motions can cause injuries and damage to property. If work is carried out on an operable system, the main switch on the control cabinet must be turned to the OFF position and secured with a padlock to prevent unauthorized persons from switching it on again. Warn all persons concerned before putting the system back into operation.

Preconditions

- ≡ The arm is in the horizontal position as shown in (>>> Fig. 12-27).
- ≡ Axes 4, 5 and 6 should, if possible, be in their zero positions.
- ≡ A crane, appliance or rope with adequate carrying capacity must be available.
- ≡ Remove the payload (tool or device) from the in-line wrist.

WARNING The in-line wrist and the arm can be damaged or persons injured if the in-line wrist is not safely secured. The in-line wrist weighs approx. 130 kg. The crane and rope must therefore be able to support this load safely.

Procedure for removal

1. Fasten the lifting device to the in-line wrist and the crane (>>> Fig. 12-27).

2. Move the crane until the weight of the in-line wrist is supported by the crane.
3. Remove 20 Allen screws. In the same hole circle there are also two M6 Allen screws, one at the top and one at the bottom; these must not be slackened.
4. Pull the in-line wrist out of the arm until connectors XM6 and XP6 are accessible.
Do not tilt it when removing it. The gap between the arm and the in-line wrist must be uniform at all times round the entire circumference. Also move the crane at the same time as pulling out the in-line wrist. The connecting shafts must not be subjected to any load while the in-line wrist is being pulled out.
5. Release and unplug connectors XM6 and XP6.
6. Place in-line wrist on suitable support.
7. If the in-line wrist is not to be reinstalled, it must be protected against corrosion before being put into storage.

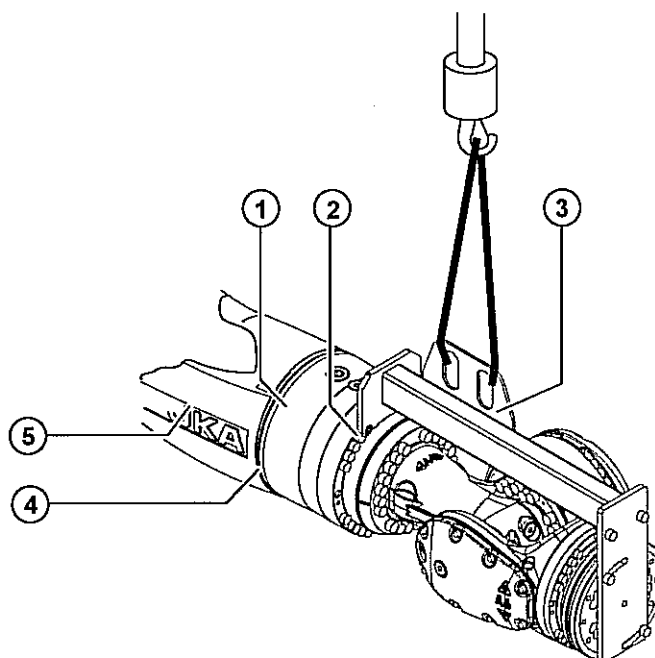


Fig. 12-27: Removing the in-line wrist

- | | |
|------------------|-------|
| 1 In-line wrist | 4 Gap |
| 2 Allen screws | 5 Arm |
| 3 Lifting device | |

12.8.2 Installing the in-line wrist

Description

All of the in-line wrist variants are installed in the same way, irrespective of the payload or arm length. In the following description, only the removal of the IW 270/300 in-line wrist will be described.

WARNING

When work is performed on this system, live parts and unintentional robot motions can cause injuries and damage to property. If work is carried out on an operable system, the main switch on the control cabinet must be turned to the OFF position and secured with a padlock to prevent unauthorized persons from switching it on again. Warn all persons concerned before putting the system back into operation.

Preconditions

- The arm is in the horizontal position.
- Axes 4, 5 and 6 should, if possible, be in their zero positions.
- A crane, lifting device and rope with adequate carrying capacity must be available.
- The motors of axes 4 and 5 must be removed.

WARNING The in-line wrist and the arm can be damaged or persons injured if the in-line wrist is not safely secured. The in-line wrist weighs approx. 130 kg. The crane and rope must therefore be able to support this load safely.

Procedure for installation

1. Remove all protective coatings and oil from new in-line wrist, if applicable. Clean the toothing on the connecting shafts and on the in-line wrist before installation and apply a thin but continuous coat of Microlube GL 261 grease (>>> Fig. 12-28).

NOTICE When installing the in-line wrist, it must be ensured that the toothing of the in-line wrist and connecting shafts is not damaged.

2. Fasten the lifting device to the in-line wrist.
 3. Pick up the in-line wrist with the crane, bring it to the installation site and ensure that axes 4 and 6 are in their zero positions.
 4. Ensure that the connecting shafts are not damaged or subjected to any load during transportation and insertion.
 5. Insert the in-line wrist into the arm until the connectors can be plugged in.
 6. Plug in connectors XP6 and XM6 and then insert the in-line wrist all the way into the arm.
- Ensure that the cables are in the correct position in the arm. The position can be checked through the openings for the motors.
7. Insert 20 M10x200-10.9 Allen screws.
 8. Tighten 20 Allen screws with a torque wrench in diagonally opposite sequence. Gradually increase the tightening torque to a value of 60 Nm.

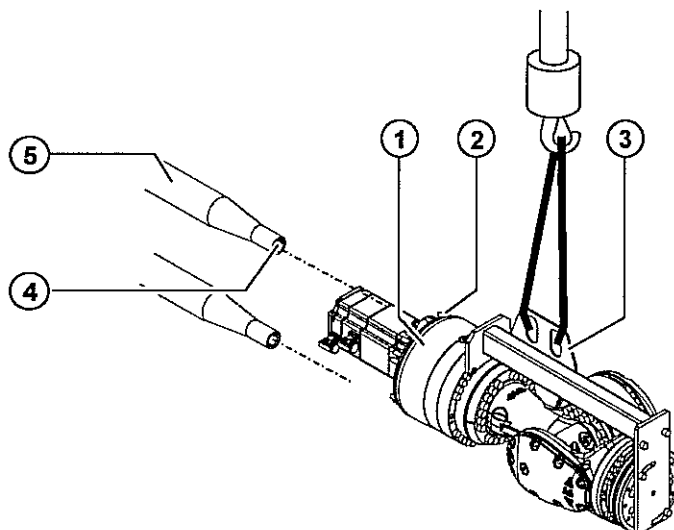


Fig. 12-28: Installing the in-line wrist

1 In-line wrist

4 Toothing

- 2 Allen screws
- 3 Lifting device
- 5 Connecting shaft
- 9. Remove the appliance or rope sling.
- 10. Install the motors of axes 4 and 5 (>>> 12.4.2 "Installing the motor on axis 4" Page 138), (>>> 12.5.2 "Installing the motor on axis 5" Page 142).
- 11. Carry out mastering of axes 4, 5 and 6.



Detailed information about mastering is contained in the operating and programming instructions for end users or system integrators.

13 Decommissioning, storage and disposal

13.1 Decommissioning

- Description** This section describes all the work required for decommissioning the robot if the robot is to be removed from the system. After decommissioning, it is prepared for storage or for transportation to a different location.
- Following its removal, the robot can be transported by means of transport tackle and crane or by fork lift truck.
- Preconditions**
- The removal site must be accessible with a crane or with a fork lift truck for transportation.
 - There is no hazard posed by system components.

Procedure

⚠ WARNING When carrying out the following work, the robot must be moved several times between the individual work steps. While work is being carried out on the robot, it must always be secured by activating the EMERGENCY STOP device. Unintentional robot motions can cause injuries and damage to property. If work is carried out on an operational robot that is switched on, the robot can only be moved in T1 mode (reduced velocity). It must be possible to stop the robot at any time by activating an EMERGENCY STOP device. Operation must be limited to what is absolutely necessary. Warn all persons concerned before switching on and moving the robot.

1. Secure the robot.
2. Remove tools and equipment.
3. Put the robot into operation and move it into the transport position (>>> Fig. 13-1).

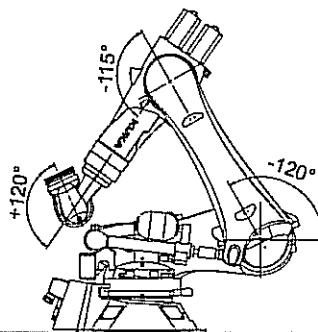


Fig. 13-1: Transport position

4. Secure the robot by activating the E-STOP device and then shut down the robot (>>> Fig. 13-2).
5. Release and unplug all peripheral connections.
6. Release and unplug the motor cable and data cable connectors.
7. Unscrew the hexagon nut from the ground conductor, take off the washers and lock washers and pull off the ground conductor.
8. Screw in the eyebolts and attach lifting tackle to the robot or prepare the robot for transportation with the fork lift truck. Minimum payload capacity of the fork lift truck for transportation: approx. 3,500 kg.
If, due to its installation position, it is not possible to lift the robot with a fork lift truck or with a crane and lifting tackle, the "Recovery aid" accessory (00-187-214) is available as an option (>>> 14 "Options" Page 161).
9. Unscrew and remove the 8 hexagon bolts and conical spring washers.

10. Lift the robot vertically off the mounting surface and transport it away.
Take care not to damage the two pins when lifting off the robot.

CAUTION

If the robot is caught on the mounting surface, it may come free abruptly, endangering persons and property. The robot must stand loosely on the mounting surface; completely remove all fastening materials and any adhesives.

11. Prepare the robot for storage.

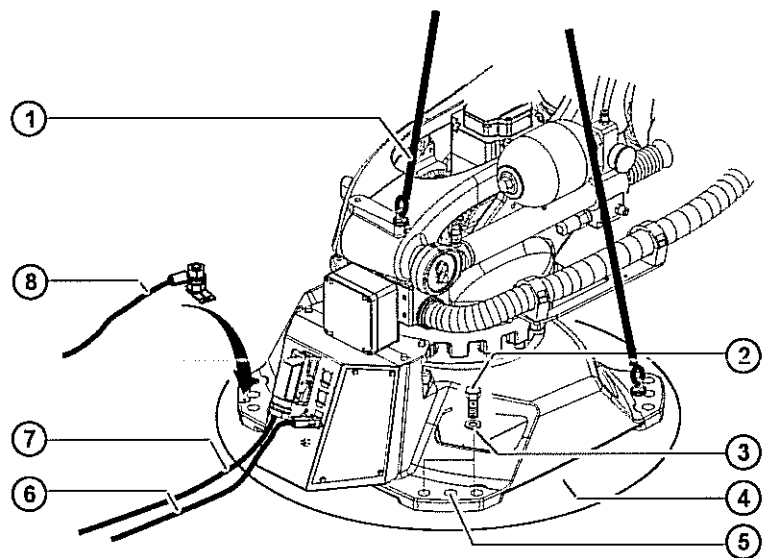


Fig. 13-2: Removing the robot

- | | |
|--------------------------|--------------------|
| 1 Lifting tackle | 5 Pin |
| 2 Hexagon bolts | 6 Data cable |
| 3 Conical spring washers | 7 Motor cable |
| 4 Mounting surface | 8 Ground conductor |

13.2 Storage

Description

If the robot is to be put into long-term storage, the following points must be observed:

- ≡ The place of storage must be as dry and dust-free as possible.
- ≡ Avoid temperature fluctuations.
- ≡ Avoid wind and drafts.
- ≡ Avoid condensation.
- ≡ Use appropriate coverings that cannot detach themselves and which can withstand the expected environmental conditions.
- ≡ Do not leave any loose parts on the robot, especially ones that might knock against other parts.
- ≡ Do not leave the robot exposed to direct sunlight while in storage.
- ≡ Observe and comply with the permissible temperature ranges for storage.
- ≡ Select a storage location in which the packaging materials cannot be damaged.

Procedure

1. Remove the robot.
2. Remove tools and equipment.

3. Clean and dry the robot. No dirt or cleaning agent residue may remain on or in the robot.
4. Perform a visual inspection of the robot.
5. Remove any foreign bodies.
6. Remove any corrosion.
7. Attach all covers to the robot and check that the seals are correctly in place.
8. Seal off electrical connections with suitable covers.
9. Seal hose connections by suitable means.
10. Cover the robot with plastic film and seal it at the base frame against dust.
If necessary, add a desiccant beneath the sheeting.

13.3 Disposal

When the robot reaches the end of its useful life, it can be removed from the system and dismantled, and the materials can be disposed of properly by type.

The following table provides an overview of the materials used in the robot. All plastic components are marked with a material designation and must be disposed of accordingly.

Material designation	Subassembly, component	Note
Light alloy casting	In-line wrist housing, spur gear housing, swivel housing, arm	
Cast-iron material	Base frame, rotating column, link arm, wrist main body	
Steel	Gear units, screws and washers	
	Motors	Dispose of motors without dismantling them.
PUR	Cable sheaths	
ETFE	Flexible tube, protective fabric sleeve	
Copper	Cables, wires	
PU	Hoses	
Cable grease	Cabling	See safety data sheet, consumables (>>> 15.2.1 "Safety data sheet for Optitemp RB1 cable grease" Page 163)
Oil	Gear units	See safety data sheet, consumables (>>> 15.2.5 "Safety data sheet for Optigear Synthetic RO 150 oil" Page 184)
Hydraulic oil	Counterbalancing system	See safety data sheet, consumables (>>> 15.2.4 "Safety data sheet for Castrol Hyspin ZZ 46 hydraulic oil" Page 177)

Material, designation	Subassembly, component	Note
Lubricating grease	Gear teeth	See safety data sheet, consumables (>>> 15.2.2 "Safety data sheet for Microlube GL 261 lubricating grease" Page 168)
Lubricating grease	Counterbalancing system, bearing on arm / link arm	See safety data sheet, consumables (>>> 15.2.3 "Safety data sheet for LGEP 2 extreme pressure grease" Page 173)
PA 6, PA R AB	Hinged clamps, flexible tubes	
Viton, FKM, FPM	O-rings	
PE 500	End stop buffer	

14 Options

14.1 Mounting flange, adapter (optional)

Description

This mounting flange (adapter) (>>> 14.1 "Mounting flange, adapter (optional)" Page 161) can be fitted on the 150/180/210 kg in-line wrist to convert it to a mounting flange with D=160. This enables e.g. tools to be used which are dimensioned for the in-line wrist with the D=160 mounting flange. The design of the flange also allows mounting of the holder A6 of the energy supply systems A3-A6.

When this adapter is mounted, the distance between the intersection of A4/A5 and the face of the mounting flange is offset forward by 25 mm.

The reference point for the load center of gravity remains unchanged and thus corresponds to the values for the in-line wrist IW 150/180/210.

The mounting flange is depicted (>>> Fig. 14-1) with axes 4 and 6 in the zero position. The symbol X_m indicates the position of the locating element (bushing) in the zero position.

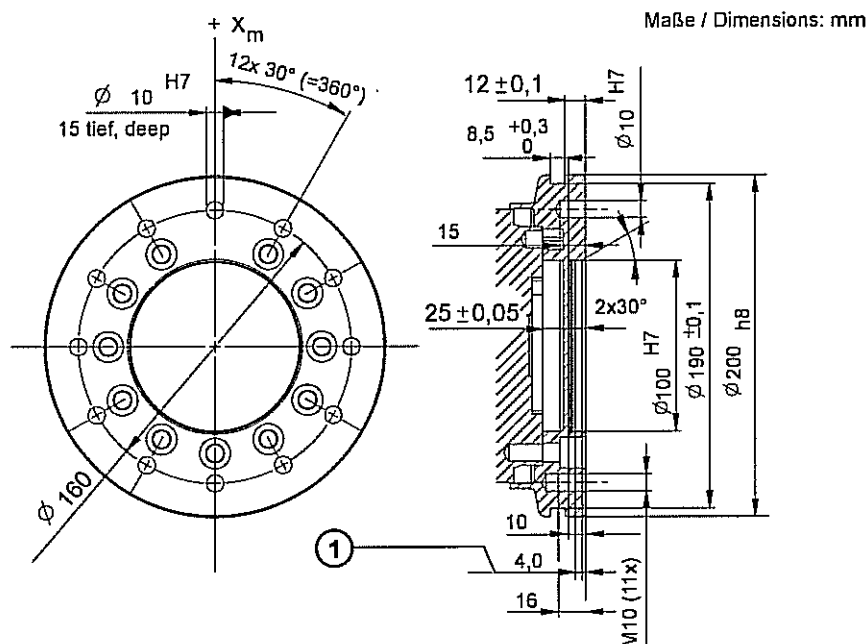


Fig. 14-1: Mounting flange, adapter

1 Fitting length

Mounting flange, adapter	IW 150/180/210 to IW 210/240
Hole circle	160 mm
Screw grade	10.9
Screw size	M10
Number of fastening threads	11
Grip length	1.5 x nominal diameter
Depth of engagement	min. 12 mm, max. 16 mm
Locating element	10 ^{H7}

14.2 Working range limitation, supplementary stop (optional)

Description

The working range limitation (>>> Fig. 14-2) can be used to restrict the available working range about axis 1 in 20° steps in both the plus and minus directions. The assembly consists of two stops with the relevant fastening screws.

Depending on the mounting position of the stops, the available range can be set from min. $\pm 5^\circ$ to max. $\pm 105^\circ$. Due to the trailing stop, there is always a residual range of 90° , which cannot be limited.

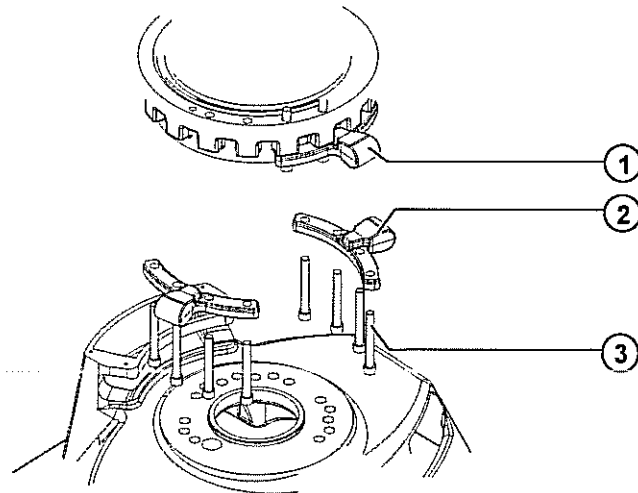


Fig. 14-2: Working range limitation A1 (optional)

- 1 Standard stop
- 2 Supplementary stops
- 3 Fastening screws

14.3 Control cable for single axis (optional)

Description

The control cable for single axis is used when additional axes (e.g. KUKA linear unit or turntables) are controlled via the robot. In this case, the control cable is guided from the RDC box through the hollow shaft of axis 1 to a connector interface on the push-in module.

14.4 Release device (optional)

Description

The release device can be used to move the manipulator manually after an accident or malfunction. The release device can be used for the motors of axes 1 to 5. It cannot be used for axis 6, as this motor is not accessible. It is only for use in exceptional circumstances and emergencies (e.g. for freeing people).

The release device is mounted on the base frame of the manipulator. This assembly also includes a ratchet and a set of plates with one plate for each motor. The plate specifies the direction of rotation for the ratchet and shows the corresponding direction of motion of the manipulator.

15 Appendix

15.1 Tightening torque

Tightening torque The following tightening torques are valid for screws and nuts where no other specifications are given.

Screw size	Strength class		
	8.8	10.9	12.9
M1.6	0.17	0.24	0,28
M2	0,35	0,48	0,56
M2.5	0.68	0.93	1.1
M3	1.2 Nm	1.6 Nm	2.0 Nm
M4	2.8 Nm	3.7 Nm	4.4 Nm
M5	5.6 Nm	7.5 Nm	9.0 Nm
M6	9.5 Nm	12.5 Nm	15.0 Nm
M8	23.0 Nm	31.0 Nm	36.0 Nm
M10	45.0 Nm	60.0 Nm	70.0 Nm
M12	78.0 Nm	104.0 Nm	125.0 Nm
M14	125.0 Nm	165.0 Nm	195.0 Nm
M16	195.0 Nm	250.0 Nm	305.0 Nm
M20	370.0 Nm	500.0 Nm	600.0 Nm
M24	640.0 Nm	860.0 Nm	1030.0 Nm
M30	1330.0 Nm	1700.0 Nm	2000.0 Nm

Tighten M5 domed cap nuts with a torque of 4.2 Nm.

15.2 Safety data sheets

15.2.1 Safety data sheet for Optitemp RB1 cable grease

The following extract from the safety data sheet according to 91/155/EEC must be observed.

15.2.1.1 Designation of substance/formulation and manufacturer

Name of substance/preparation	
Trade name:	Optitemp RB1
SDS no.:	455577
Use:	Lubricant

Manufacturer designation	
Company:	Deutsche BP Aktiengesellschaft, Industrial Lubricants & Services
Address:	Erkelenzer Strasse 20, D-41179 Mönchengladbach
Country:	Germany
Tel.:	+49 (0)2161 909 319
Fax:	+49 (0)2161 909 392
Emergency hotline:	Carechem: +44 (0)208 762 8322
e-mail address:	MSDSadvice@bp.com

15.2.1.2 Composition / Information about the components

Chemical characterization:	Synthetic lubricant and additives. Thickeners.
Hazardous components:	This product contains no dangerous components above the legally defined limit values.

15.2.1.3 Possible hazards

The preparation is **NOT** classified as hazardous in accordance with Directive 1999/45/EC in its altered and adapted version.

Physical / chemical hazards:	Not classified as dangerous.
Human health hazards:	May irritate eyes and skin.
Environmental hazards:	Unlikely to be harmful to aquatic organisms.

Effects and symptoms	
Eyes:	May cause mild eye irritation.
Skin:	Can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Inhalation:	Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.
Ingestion:	Ingestion may cause gastrointestinal irritation (e.g. diarrhea).

15.2.1.4 First aid measures

Contact with eyes:	Rinse eyes immediately with plenty of water for several minutes. If irritation occurs, consult a doctor.
Skin contact:	Wash affected areas of skin with soap and water, or use suitable cleaning agent. Change clothing and shoes if they become contaminated with product. Wash clothing before reuse. Clean shoes thoroughly before reuse. If irritation occurs consult a doctor.
Inhalation:	Take affected person into fresh air. Consult a doctor if symptoms persist.
Ingestion:	Do not induce vomiting. If the person is unconscious, do not give anything by mouth. Consult a physician immediately.
Notes to physician:	Treatment should in general be symptomatic and directed at relieving any effects. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. Within a few hours the tissue swells up and becomes discolored and extremely painful, with severe subcutaneous necrosis. Surgical treatment is absolutely imperative. Comprehensive opening of the wound and the tissue beneath it is necessary in order to reduce tissue loss and to prevent or limit lasting damage. The high pressure can cause the product to penetrate extensive areas of tissue layers.

15.2.1.5 Fire-fighting measures

Suitable extinguishing agents:	In the event of a fire: use water spray (mist), foam, dry chemicals or CO ₂ .
Unsuitable extinguishing agents:	Do not use water jets.
Special instructions for extinguishing work:	Contaminated extinguishing water must be collected separately and prevented from entering the drainage system.
Hazardous decomposition products:	Decomposition products include various oxides (e.g. carbon oxides).
Unusual fire/explosion hazards:	This product is not inherently explosive in accordance with the applicable rules.
Special fire-fighting measures:	-
Protection of fire-fighters:	Fire-fighters must wear self-contained positive pressure breathing apparatus (SCBA) and full protective gear.

15.2.1.6 Measures after unintended release

Personal safety precautions:	In case of spillage, isolate the hazard area. Avoid contact with the hazardous substance and avoid inhaling vapors. Ensure adequate ventilation. Where there is insufficient ventilation, wear suitable respiratory equipment. Use suitable protective equipment.
Environmental protection measures:	Prevent the product from entering the drainage system, surface waters and soil. Notify the competent authorities, if required.
Large spills:	Stop the leak if you can do so without risk. Remove container from spill area. Flush spilled material into a wastewater treatment plant. Contain spilled material using a non-combustible absorbent (e.g. sand, soil, vermiculite, diatomaceous earth) and collect in the containers provided. Disposal should be entrusted to a recognized waste disposal company. Contaminated absorbents can be just as dangerous.
Small spills:	Stop the leak if you can do so without risk. Remove container from spill area. Dilute with water and mop up, or add absorbent material and place the substance in a suitable container for disposal. Disposal should be entrusted to a recognized waste disposal company.

15.2.1.7 Handling and storage

Handling:	Prevent contact with skin or clothing. Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Wash thoroughly after handling.
Storage:	Keep containers tightly sealed. Keep containers in a cool, well-ventilated area.
Unsuitable:	Avoid prolonged exposure to increased temperatures.
VCI storage class:	11

15.2.1.8 Exposure limits and personal protective equipment

Threshold limit values (TLV):	No occupational exposure threshold limit values have been assigned for this product.
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Protective measures	
Limitation and monitoring of exposure in the workplace:	Provide exhaust ventilation or other engineering controls.
Hygiene measures:	Wash hands, forearms and face thoroughly after handling chemical products.
Respiratory protection:	Sufficient ventilation is recommended in industry. If ventilation is insufficient, respiratory protection is useful.
Hand protection:	Wear chemical-resistant gloves (recommended: nitrile gloves) if prolonged or repeated contact is likely.
Eye protection:	Protective goggles with side shields to guard against splashing.
Skin and body:	Wear appropriate clothing to avoid prolonged skin contact.

15.2.1.9 Physical and chemical properties

Physical state:	Paste
Color:	Light beige
Odor:	Slight
Flash point:	Closed cup: > 150 °C
Vapor pressure:	<0.01 kPa (<0.075 mm Hg) at 20 °C
Penetration number (0.1 mm)	280 at 25 °C
Melting point/range:	192 °C
Drop point:	> 180 °C
Density:	<1000 kg/m ³ (<1 g/cm ³) at 20 °C
Solubility:	Insoluble in water

15.2.1.10 Stability and reactivity

Incompatible with various substances:	Reactive or incompatible with oxidizing materials.
Hazardous polymerization:	The product is stable. No hazardous polymerization occurs under normal conditions.
Hazardous decomposition products:	Decomposition products may include various oxides (e.g. carbon oxides). No hazardous decomposition products should be formed under normal conditions of storage and use.

15.2.1.11 Toxicological information

Chronic effects:	No particular effects or risks known.
Effects on eyes:	May cause mild eye irritation.
Effects on skin:	Prolonged or repeated contact can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Effect if inhaled:	Vapors and aerosols may cause irritation of the mucous membranes of the nose and throat.
Effect if ingested:	May cause nausea, vomiting and diarrhea.

15.2.1.12 Ecological information

Persistence / degradability:	Biodegradable.
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Mobility:	The product is non-volatile. Insoluble in water.
Environmental hazards:	Not classified as dangerous.

15.2.1.13 Disposal information

Disposal information	
Disposal information / waste specifications:	Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Observe local, regional and national regulations. Use only approved transporters, recyclers, treatment, storage or disposal facilities. If necessary, disposal should be entrusted to a recognized waste disposal company.

Unused product	
European Waste Catalog (EWC):	Waste code 12 01 12: Used waxes and greases

Packaging	
European Waste Catalog (EWC):	Waste code 15 01 10: Packaging containing the residue of hazardous materials or contaminated by hazardous materials.

Use of the product for purposes other than those specified and/or impurities can necessitate the use of a different waste code number for the waste producer.

Hazardous waste	
On the basis of the supplier's current state of knowledge, this product is not considered as hazardous waste as defined by EU directive 91/689/EC.	

15.2.1.14 Transport information

Classification:	Not hazardous as defined by the transport regulations (ADR/ RID, ADN, IMDG, ICAO/IATA).
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15.2.1.15 Regulations

EU regulations:	EC Directives 1999/45/EC and 67/548/EEC.
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Labeling requirements	
Risk (R) phrases:	This product is not classified according to the Dangerous Substances Order / EU regulations.
Additional warning labels:	Contains acetic acid, (4-nonylphenoxyl). Can cause allergic reactions.

Miscellaneous provisions	
Inventories:	European inventory: All components are listed or exempted. US inventory (TSCA 8b): All components are listed or exempted. Australian inventory (AICS): At least one component is not listed. Canadian inventory: At least one component is not listed. Inventory of Existing Chemical Substances in China (IECSC): At least one component is not listed. Japanese inventory of Existing and New Chemical Substances (ENCS): At least one component is not listed. Korean Existing Chemicals Inventory (KECI): All components are listed or exempted. Philippine Inventory of Chemicals and Chemical Substances (PICCS): All components are listed or exempted.
Classification acc. to the German Administrative Regulation on the Classification of Substances Hazardous to Water into Water Hazard Classes (VwVwS):	1, Annex no. 4

15.2.1.16 Other information

Notes for the reader
All information is based on the current state of our knowledge. It is intended only to describe our product with regard to the safety data. It is not intended to provide assurance of particular properties. The product may only be used for the scope of work specified above; any other use requires prior consultation with KUKA. Using the product for any purpose other than for its designated use could lead to risks which are not described in this document. Further information on the use of the product may be found in the relevant technical specifications.

15.2.2 Safety data sheet for Microlube GL 261 lubricating grease

The following extract from the safety data sheet according to 91/155/EEC must be observed.

15.2.2.1 Designation of substance/formulation and manufacturer

Name of substance/preparation	
Trade name:	Microlube GL 261
Article no.:	020195
Use:	Lubricating grease

Manufacturer designation	
Company:	Klüber Lubrication München AG
Address:	Geisenhausenerstr. 7
Postal code:	D-81379 München

Manufacturer designation	
Country:	Germany
Telephone:	+49 (0)89 7876 0
Fax:	+49 (0)89 7876 333
Information center:	Material Compliance Management
Emergency hotline:	+49 (0)89 7876-700

15.2.2.2 Composition / Information about the components

Chemical characterization:	Mineral oil, lithium special soap, UV indicator
Hazardous components:	This product contains no dangerous components above the legally defined limit values.

15.2.2.3 Possible hazards

The preparation is **NOT** classified as hazardous in accordance with Directive 1999/45/EC in its altered and adapted version.

Physical / chemical hazards:	Not classified as dangerous.
Human health hazards:	May irritate eyes and skin.
Environmental hazards:	Unlikely to be harmful to aquatic organisms.

Effects and symptoms	
Eyes:	May cause mild eye irritation.
Skin:	Can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Inhalation:	Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.
Ingestion:	Ingestion may cause gastrointestinal irritation (e.g. diarrhea).

15.2.2.4 First aid measures

Contact with eyes:	Rinse eyes immediately with plenty of water for several minutes. If irritation occurs, consult a doctor.
Skin contact:	Wash affected areas of skin with soap and water, or use suitable cleaning agent. Change clothing and shoes if they become contaminated with product. Wash clothing before reuse. Clean shoes thoroughly before reuse. If irritation occurs consult a doctor.
Inhalation:	Take affected person into fresh air. Consult a doctor if symptoms persist.

Ingestion:	Do not induce vomiting. If the person is unconscious, do not give anything by mouth. Consult a physician immediately.
Notes to physician:	Treatment should in general be symptomatic and directed at relieving any effects. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. Within a few hours the tissue swells up and becomes discolored and extremely painful, with severe subcutaneous necrosis. Surgical treatment is absolutely imperative. Comprehensive opening of the wound and the tissue beneath it is necessary in order to reduce tissue loss and to prevent or limit lasting damage. The high pressure can cause the product to penetrate extensive areas of tissue layers.

15.2.2.5 Fire-fighting measures

Suitable extinguishing agents:	In the event of a fire: use water spray (mist), foam, dry chemicals or CO ₂ .
Unsuitable extinguishing agents:	Do not use water jets.
Special instructions for extinguishing work:	Contaminated extinguishing water must be collected separately and prevented from entering the drainage system.
Hazardous decomposition products:	Decomposition products include various oxides (e.g. carbon oxides).
Unusual fire/explosion hazards:	This product is not inherently explosive in accordance with the applicable rules.
Special fire-fighting measures:	-
Protection of fire-fighters:	Fire-fighters must wear self-contained positive pressure breathing apparatus (SCBA) and full protective gear.

15.2.2.6 Measures after unintended release

Personal safety precautions:	In case of spillage, isolate the hazard area. Avoid contact with the hazardous substance and avoid inhaling vapors. Ensure adequate ventilation. Where there is insufficient ventilation, wear suitable respiratory equipment. Use suitable protective equipment.
Environmental protection measures:	Prevent the product from entering the drainage system, surface waters and soil. Notify the competent authorities, if required.
Large spills:	Stop the leak if you can do so without risk. Remove container from spill area. Flush spilled material into a wastewater treatment plant. Contain spilled material using a non-combustible absorbent (e.g. sand, soil, vermiculite, diatomaceous earth) and collect in the containers provided. Disposal should be entrusted to a recognized waste disposal company. Contaminated absorbents can be just as dangerous.
Small spills:	Stop the leak if you can do so without risk. Remove container from spill area. Dilute with water and mop up, or add absorbent material and place the substance in a suitable container for disposal. Disposal should be entrusted to a recognized waste disposal company.

15.2.2.7 Handling and storage

Handling:	Prevent contact with skin or clothing. Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Wash thoroughly after handling.
Storage:	Keep containers tightly sealed. Keep containers in a cool, well-ventilated area.
Unsuitable:	Avoid prolonged exposure to increased temperatures.

VCI storage class:	11
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15.2.2.8 Exposure limits and personal protective equipment

Threshold limit values (TLV):	No occupational exposure threshold limit values have been assigned for this product.
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Protective measures	
Limitation and monitoring of exposure in the workplace:	Provide exhaust ventilation or other engineering controls.
Hygiene measures:	Wash hands, forearms and face thoroughly after handling chemical products.
Respiratory protection:	Sufficient ventilation is recommended in industry. If ventilation is insufficient, respiratory protection is useful.
Hand protection:	Wear chemical-resistant gloves (recommended: nitrile gloves) if prolonged or repeated contact is likely.
Eye protection:	Protective goggles with side shields to guard against splashing.
Skin and body:	Wear appropriate clothing to avoid prolonged skin contact.

15.2.2.9 Physical and chemical properties

Physical state:	Paste
Color:	Tan
Odor:	Specific
Flash point:	-
Drop point:	>220 °C (DIN ISO 2176)
Density:	<1,000 kg/m ³ (<1 g/cm ³) at 20 °C
Solubility:	Insoluble in water

15.2.2.10 Stability and reactivity

Incompatible with various substances:	Reactive or incompatible with oxidizing materials.
Hazardous polymerization:	The product is stable. No hazardous polymerization occurs under normal conditions.
Hazardous decomposition products:	Decomposition products may include various oxides (e.g. carbon oxides). No hazardous decomposition products should be formed under normal conditions of storage and use.

15.2.2.11 Toxicological information

Chronic effects:	No particular effects or risks known.
Effects on eyes:	May cause mild eye irritation.
Effects on skin:	Prolonged or repeated contact can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Effect if inhaled:	Vapors and aerosols may cause irritation of the mucous membranes of the nose and throat.
Effect if ingested:	May cause nausea, vomiting and diarrhea.

15.2.2.12 Ecological information

Persistence / degradability:	The product can be separated by mechanical means.
Mobility:	The product is insoluble in water.
Environmental hazards:	Prevent from entering wastewater and soil.

15.2.2.13 Disposal information

Disposal information	
Disposal information / waste specifications:	Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Observe local, regional and national regulations. Use only approved transporters, recyclers, treatment, storage or disposal facilities. If necessary, disposal should be entrusted to a recognized waste disposal company.

Hazardous waste	
On the basis of the supplier's current state of knowledge, this product is not considered as hazardous waste as defined by EU directive 91/689/EC.	

15.2.2.14 Transport information

Classification:	Not hazardous as defined by the transport regulations (ADR/ RID, ADN, IMDG, ICAO/IATA).
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15.2.2.15 Regulations

EU regulations:	EC Directives 1999/45/EC and 67/548/EEC.
Classification acc. to the German Administrative Regulation on the Classification of Substances Hazardous to Water into Water Hazard Classes (VwVwS):	1, low hazard to waters, Annex 4

15.2.2.16 Other information

Notes for the reader
All information is based on the current state of our knowledge. It is intended only to describe our product with regard to the safety data. It is not intended to provide assurance of particular properties.
The product may only be used for the scope of work specified above; any other use requires prior consultation with KUKA. Using the product for any purpose other than for its designated use could lead to risks which are not described in this document.
Further information on the use of the product may be found in the relevant technical specifications.

15.2.3 Safety data sheet for LGEP 2 extreme pressure grease

The following extract from the safety data sheet according to 91/155/EEC must be observed.

15.2.3.1 Designation of substance/formulation and manufacturer

Name of substance/preparation	
Trade name:	LGEP 2
Use:	KF extreme pressure grease

Manufacturer designation	
Company:	SKF Maintenance Products
Address:	P.O. Box 1008
Postal code:	NL-3430, BA Nieuwegein
Country:	Netherlands
Telephone:	+31 30 6307200
Fax:	+31 30 6307205
Contact:	Sébastien David
e-mail address:	sebastien.david@skf.com

15.2.3.2 Composition / Information about the components

Chemical description	CAS no.	%	EC no.	Classification
Base oil – unspecified	-	60 - 100	-	-
Zinc dialkyl dithiophosphate	68649-42-3	<2,5	272-028-3	Xi; N; R38; R41; R51/53

15.2.3.3 Possible hazards

The preparation is classified as **hazardous** in accordance with Directive 1999/45/EC in its altered and adapted version.

Physical / chemical hazards:	Not classified as dangerous.
Human health hazards:	May irritate eyes and skin.
Environmental hazards:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Effects and symptoms	
Eyes:	May cause eye irritation.
Skin:	Can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Inhalation:	Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.
Ingestion:	Ingestion may cause gastrointestinal irritation (e.g. diarrhea).

15.2.3.4 First aid measures

Contact with eyes:	Rinse eyes immediately with plenty of water for several minutes. If irritation occurs, consult a doctor.
Skin contact:	Wash affected areas of skin with soap and water, or use suitable cleaning agent. Change clothing and shoes if they become contaminated with product. Wash clothing before reuse. Clean shoes thoroughly before reuse. If irritation occurs consult a doctor.
Inhalation:	Take affected person into fresh air. Consult a doctor if symptoms persist.
Ingestion:	Do not induce vomiting. If the person is unconscious, do not give anything by mouth. Consult a physician immediately.
Notes to physician:	Treatment should in general be symptomatic and directed at relieving any effects. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. Within a few hours the tissue swells up and becomes discolored and extremely painful, with severe subcutaneous necrosis. Surgical treatment is absolutely imperative. Comprehensive opening of the wound and the tissue beneath it is necessary in order to reduce tissue loss and to prevent or limit lasting damage. The high pressure can cause the product to penetrate extensive areas of tissue layers.

15.2.3.5 Fire-fighting measures

Suitable extinguishing agents:	In the event of a fire: use water spray (mist), foam, dry chemicals or CO ₂ .
Unsuitable extinguishing agents:	Do not use water jets.
Special instructions for extinguishing work:	Contaminated extinguishing water must be collected separately and prevented from entering the drainage system.
Hazardous decomposition products:	Decomposition products include various oxides (e.g. carbon oxides).
Unusual fire/explosion hazards:	This product is not inherently explosive in accordance with the applicable rules.
Special fire-fighting measures:	-
Protection of fire-fighters:	Fire-fighters must wear self-contained positive pressure breathing apparatus (SCBA) and full protective gear.

15.2.3.6 Measures after unintended release

Personal safety precautions:	In case of spillage, isolate the hazard area. Avoid contact with the hazardous substance and avoid inhaling vapors. Ensure adequate ventilation. Where there is insufficient ventilation, wear suitable respiratory equipment. Use suitable protective equipment.
Environmental protection measures:	Prevent the product from entering the drainage system, surface waters and soil. Notify the competent authorities, if required.
Large spills:	Stop the leak if you can do so without risk. Remove container from spill area. Flush spilled material into a wastewater treatment plant. Contain spilled material using a non-combustible absorbent (e.g. sand, soil, vermiculite, diatomaceous earth) and collect in the containers provided. Disposal should be entrusted to a recognized waste disposal company. Contaminated absorbents can be just as dangerous.
Small spills:	Stop the leak if you can do so without risk. Remove container from spill area. Dilute with water and mop up, or add absorbent material and place the substance in a suitable container for disposal. Disposal should be entrusted to a recognized waste disposal company.

15.2.3.7 Handling and storage

Handling:	Prevent contact with skin or clothing. Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Wash thoroughly after handling.
Storage:	Keep containers tightly sealed. Keep containers in a cool, well-ventilated area.
Unsuitable:	Avoid prolonged exposure to increased temperatures.

15.2.3.8 Exposure limits and personal protective equipment

Threshold limit values (TLV):	No occupational exposure threshold limit values have been assigned for this product.
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Protective measures	
Limitation and monitoring of exposure in the workplace:	Provide exhaust ventilation or other engineering controls.
Hygiene measures:	Wash hands, forearms and face thoroughly after handling chemical products.
Respiratory protection:	Sufficient ventilation is recommended in industry. If ventilation is insufficient, respiratory protection is useful.
Hand protection:	Wear chemical-resistant gloves (recommended: nitrile gloves) if prolonged or repeated contact is likely.
Eye protection:	Protective goggles with side shields to guard against splashing.
Skin and body:	Wear appropriate clothing to avoid prolonged skin contact.

15.2.3.9 Physical and chemical properties

Physical state:	Paste
Color:	Tan
Odor:	Mineral oil
Flash point:	> 150 °C

Density:	<1000 kg/m ³ (<1 g/cm ³) at 25 °C
Solubility:	Insoluble in water

15.2.3.10 Stability and reactivity

Incompatible with various substances:	Reactive or incompatible with oxidizing materials.
Hazardous polymerization:	The product is stable. No hazardous polymerization occurs under normal conditions.
Hazardous decomposition products:	Decomposition products may include various oxides (e.g. carbon oxides). No hazardous decomposition products should be formed under normal conditions of storage and use.

15.2.3.11 Toxicological information

Chronic effects:	No particular effects or risks known.
Effects on eyes:	May cause mild eye irritation.
Effects on skin:	Prolonged or repeated contact can dry out the skin and lead to irritation and/or dermatitis. Allergic reactions are possible in the worst case.
Effect if inhaled:	Vapors and aerosols may cause irritation of the mucous membranes of the nose and throat.
Effect if ingested:	May cause nausea, vomiting and diarrhea.

15.2.3.12 Ecological information

Persistence / degradability:	Not easily biodegradable.
Mobility:	The product is insoluble in water. It floats on water.
Environmental hazards:	Prevent from entering wastewater and soil.

15.2.3.13 Disposal information

Disposal information	
Disposal information / waste specifications:	Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Observe local, regional and national regulations. Use only approved transporters, recyclers, treatment, storage or disposal facilities. If necessary, disposal should be entrusted to a recognized waste disposal company.

Unused product	
European Waste Catalog (EWC):	Waste code 13 02 08*: Other machine oils, gear oils and lubricating oils

Used/contaminated product	
European Waste Catalog (EWC):	Waste code 13 02 08*: Other machine oils, gear oils and lubricating oils

Use of the product for purposes other than those specified and/or impurities can necessitate the use of a different waste code number for the waste producer.

Hazardous waste

This product is listed as a hazardous substance by the EU Directive on hazardous waste. Dispose of in accordance with all national and local regulations and statutory provisions in force.

15.2.3.14 Transport information

Classification:	Not hazardous as defined by the transport regulations (ADR/RID, ADN, IMDG, ICAO/IATA).
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15.2.3.15 Regulations

EU regulations:	EC Directives 1999/45/EC and 67/548/EEC.
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Labeling requirements	
Safety warning	Irritant
R Phrases:	R38 - Irritating to skin. R41 - Risk of serious damage to eyes. R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety (S) phrases:	S24/25 - Avoid contact with eyes and skin. S37 - Wear suitable gloves.

List of relevant R-phrases
R38 - Irritating to skin. R41 - Risk of serious damage to eyes. R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

15.2.3.16 Other information

Notes for the reader
All information is based on the current state of our knowledge. It is intended only to describe our product with regard to the safety data. It is not intended to provide assurance of particular properties.
The product may only be used for the scope of work specified above; any other use requires prior consultation with KUKA. Using the product for any purpose other than for its designated use could lead to risks which are not described in this document.
Further information on the use of the product may be found in the relevant technical specifications.

15.2.4 Safety data sheet for Castrol Hyspin ZZ 46 hydraulic oil

The following extract from the safety data sheet according to 91/155/EEC must be observed.

15.2.4.1 Designation of substance/formulation and manufacturer

Name of substance/preparation	
Product name:	Castrol Hyspin ZZ 46

Name of substance/preparation	
SDS no.:	450828
Use of substance or formulation:	Hydraulic oil
	For specific instructions for use, see the corresponding technical data sheet or contact a company representative.

Manufacturer designation	
Company:	Deutsche Castrol Vertriebsgesellschaft mbH
Address:	Max-Born-Str. 2, D-22761 Hamburg
Country:	Germany
Telephone:	Central customer service/environment/product safety: +49 (0)40 3594 01
Emergency hotline:	Carechem: +44 (0)208 762 8322 (24 hours)

15.2.4.2 Composition / Information about the components

Highly refined base oil (IP 346 DMSO extract < 3%). Additives.

This product contains no dangerous components above the legally defined limit values.

15.2.4.3 Possible hazards

The preparation is not classified as hazardous in accordance with Directive 1999/45/EC in its altered and adapted version.

Physical / chemical hazards:	Not classified as dangerous.
Human health hazards:	Not classified as dangerous.
Environmental hazards:	Unlikely to be harmful to aquatic organisms.

Effects and symptoms	
Eyes:	No significant health hazards identified.
Skin:	No significant health hazards identified. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. See Notes to physician under "First aid measures" in this safety data sheet.
Inhalation:	No significant health hazards identified.
Ingestion:	No significant health hazards identified.

15.2.4.4 First aid measures

Contact with eyes:	In case of contact, rinse eyes immediately with plenty of water for at least 15 minutes. If irritation occurs, consult a doctor.
Skin contact:	In case of contact, rinse skin immediately with plenty of water. Change clothing and shoes if they become contaminated with product. Wash clothing before reuse. Clean shoes thoroughly before reuse. If irritation occurs consult a doctor.
Inhalation:	Take affected person into fresh air. Consult a doctor if symptoms persist.

Ingestion:	Do NOT induce vomiting unless explicitly directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this product have been swallowed, call a physician immediately.
Notes to physician:	Treatment should in general be symptomatic and directed at relieving any effects. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. The injuries appear minor at first, but within a few hours the tissue swells up and becomes discolored and extremely painful, with severe subcutaneous necrosis. Surgical treatment is absolutely imperative. Comprehensive opening of the wound and the tissue beneath it is necessary in order to reduce tissue loss and to prevent or limit lasting damage. The high pressure can cause the product to penetrate extensive areas of tissue layers.

15.2.4.5 Fire-fighting measures

Suitable extinguishing agents:	In the event of a fire, use foam, dry-chemical or carbon dioxide extinguisher or spray.
Unsuitable extinguishing agents:	Do NOT use water jets.
Hazardous decomposition products:	These products are carbon oxides (CO, CO ₂).
Unusual fire/explosion hazards:	Not specified.
Special fire-fighting measures:	Not specified.
Protection of fire-fighters:	Fire-fighters must wear self-contained positive pressure breathing apparatus (SCBA) and full protective gear.

15.2.4.6 Measures after unintended release

Personal safety precautions:	Contact emergency personnel immediately. Keep unnecessary personnel away. Use suitable protective equipment (see section: "Exposure limits and personal protective equipment"). Follow all fire-fighting procedures (see section: "Fire-fighting measures").
Environmental precautions and clean-up methods:	If no emergency personnel are available, contain spilled material. For small spills add an absorbent (soil may be used in the absence of other suitable materials) and scoop up material. Place it in a sealed watertight container for subsequent disposal. For larger spills, take steps to contain the material to ensure that runoff cannot reach a waterway. Place spilled material in an appropriate container for disposal. Prevent spilled material from coming into contact with soil and surface waters. See Section "Disposal information" for disposal information.
Personal protection in the event of a large spill:	Splash goggles, full suit, boots, gloves.

15.2.4.7 Handling and storage

Handling:	Wash thoroughly after handling.
Storage:	Keep containers tightly sealed. Keep containers in a cool, well-ventilated area.
Unsuitable:	Prolonged exposure to increased temperatures.

15.2.4.8 Exposure limits and personal protective equipment

Ingredient name:	Threshold limit values (TLV) acc. to ACGIH (USA)
Base oil – unspecified	STEL: 10 mg/m ³ 15 minute(s). Form: mineral oil mist TWA: 5 mg/m ³ 8 hour(s). Form: mineral oil mist

Where no exposure limits exist in law, the ACGIH values are included for information and as reference. For further information, please consult your supplier. It must be noted that all mists, vapors and dusts also contain other components of this preparation. For this reason, the specific limit values given in the safety data sheet for particular components may not be applicable to the product and are given here only as a guideline.

Protective measures	Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits. All chemicals should be assessed with regard to their risks to health and appropriate control measures put in place to prevent or adequately control exposure. A hierarchy of control measures exists (e.g. elimination, substitution, general ventilation, containment, systems of work, changing the process or activity) which must be considered before using personal protective equipment. Personal protective equipment should conform to the applicable standards. For this purpose, please consult your supplier of personal protective equipment. Relevant information can be obtained from the European Committee for Standardization: http://www.cenorm.be/cenorm/index.htm. The final choice of protective equipment will depend on a risk assessment. It must always be ensured that all items of personal protective equipment are compatible with one another.
Hygiene measures:	Wash hands, forearms and face thoroughly after handling chemical products and before eating, smoking or using the toilet, as well as at the end of the working day.

Personal protective equipment	
Respiratory organs:	Respiratory protection is not normally required where there is adequate natural or local exhaust ventilation to control exposure. Where there is insufficient ventilation, wear suitable respiratory equipment. Respiratory protection equipment must be checked in order to ensure a correct fit every time it is used. Air-filtering respirators, also called air-purifying respirators, are not adequate under conditions of oxygen deficiency (e.g. low oxygen concentration) and are not suitable where airborne concentrations of chemicals with a significant hazard are present. In these cases, air-supplied breathing apparatus is required. Provided an air-filtering or air-purifying respirator is suitable, a particulate filter for mist or fumes can be used. Use filter type P or comparable standard. A combination filter for particles and organic gases and vapors (boiling point >65 °C) may be necessary if vapor or abnormal odor is also present due to high product temperature. Use filter type AP or comparable standard.
Skin and body:	Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls only provide protection against light, superficial contamination which will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing), then chemical-resistant aprons and/or impervious chemical suits and boots will be required.
Hands:	Wear protective gloves if prolonged or repeated contact is likely. Wear chemical-resistant gloves. Recommended: nitrile gloves. Cold-resistant clothing is required when handling ice-cold products.
Eyes:	Protective goggles with side shields to guard against splashing.

15.2.4.9 Physical and chemical properties

Flash point:	220 °C (closed cup).
Pour point:	-21 °C.
Color:	Straw-colored.
Odor:	Oily.
Physical state:	Liquid.
Density:	876 kg/m ³ (0.876 g/cm ³) at 15 °C.
Solubility:	Insoluble in water.
LogK _{ow} :	The product is much more soluble in octanol; log(octanol/water) >3.
Viscosity:	Kinematic: 46 mm ² /s (46 cSt) at 40 °C. Kinematic: 6.65 mm ² /s (6.65 cSt) at 100 °C.

15.2.4.10 Stability and reactivity

Incompatible with various substances:	Reacts with oxidizing agents.
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Hazardous polymerization:	Will not occur.
Hazardous decomposition products:	These products are carbon oxides (CO, CO ₂).

15.2.4.11 Toxicological information

Acute toxicity:	Unlikely to cause more than transient stinging or redness if accidental eye contact occurs. Unlikely to cause harm to the skin on brief or occasional contact. Prolonged or repeated exposure may dry out the skin and lead to dermatitis. Unlikely to cause harm if accidentally swallowed in small doses. Larger quantities may cause nausea and diarrhea. At normal ambient temperatures this product is unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapor, mists or fumes resulting from thermal decomposition products occurs.
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Chronic toxicity:	
Carcinogenic effects:	No component of this product at levels greater than or equal to 0.1% is identified as a carcinogen by ACGIH, the International Agency for Research on Cancer (IARC) or the European Commission (EC).

15.2.4.12 Ecological information

Persistence / degradability:	Inherently biodegradable.
Mobility:	Spilled substance can enter the ground and contaminate soil and groundwater.
Bioaccumulative potential:	This product is not expected to bioaccumulate through food chains in the environment.
Environmental hazards:	Unlikely to be harmful to aquatic organisms.
Other ecological information:	Spilled product can lead to formation of a film on the surface of water; this can reduce the oxygen exchange, thereby causing organisms to die.

15.2.4.13 Disposal information

Disposal information	
Disposal information / waste specifications:	Disposal must be carried out by an authorized waste disposal contractor.

Used/contaminated product	
European Waste Catalog (EWC):	13 01 10* Non-chlorinated hydraulic oils with a mineral oil base.

Use of the product for purposes other than those specified and/or impurities can necessitate the use of a different waste code number for the waste producer.

15.2.4.14 Transport information

Classification:	Not hazardous as defined by the transport regulations (ADR/ RID, ADN, IMDG, ICAO/IATA).
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15.2.4.15 Regulations

Labeling requirements	
Risk (R) phrases:	This product is not classified according to the Dangerous Substances Order / EU regulations.
EU regulations:	Classification and labeling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Miscellaneous provisions	
Inventories:	Australian inventory (AICS): In compliance. Canadian inventory (DSL): In compliance. Chinese inventory (IECS): Not determined. EC inventory (EINECS/ELINCS): In compliance. Japanese inventory (ENCS): In compliance. Korean inventory (ECL): Not listed. Philippine inventory (PICCS): Not determined. US inventory (TSCA): In compliance.
Water hazard classification (WGK):	1 (low hazard to waters), classification acc. to the German Administrative Regulation on the Classification of Substances Hazardous to Waters into Water Hazard Classes (VwVwS)
Statutory Order on Hazardous Incidents (StörfallV):	12th ordinance of the German Immission Control Act (StörfallV): not listed.

15.2.4.16 Other information

History	
Date of issue:	29/03/2006.
Date of previous issue:	No previous validation.
Created by:	Product Stewardship Group.

Notes for the reader

(#) Indicates information altered since the last version.

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as at the date of issue specified below. No warranty or representation, express or implied, is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given are valid if the product is sold for the application(s) specified. The product should not be used for purposes other than the applications specified without prior consultation with us. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group accepts no responsibility for any damage or injury resulting from uses other than the stated product use of the material, from any failure to adhere to recommendations, or from hazards inherent in the nature of the material. Those purchasing the product for supply to third parties for use at work have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information on this data sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

15.2.5 Safety data sheet for Optigear Synthetic RO 150 oil

The following extract from the safety data sheet according to 91/155/EEC must be observed.

15.2.5.1 Designation of substance/formulation and manufacturer

Name of substance/preparation	
Trade name:	Optigear Synthetic RO 150
SDS no.:	465036
Historical SDS no.:	DE-05254, FR-465036, SK-5254
Use of substance or	Lubricant
Formulation:	For specific instructions for use, see the corresponding technical data sheet or contact a company representative.

Manufacturer designation	
Company:	Deutsche BP Aktiengesellschaft, Industrial Lubricants & Services
Address:	Erkelenzer Strasse 20, D-41179 Mönchengladbach
Country:	Germany
Tel.:	+49 (0)2161 909 319
Fax:	+49 (0)2161 909 392
Emergency hotline:	Carechem: +44 (0)208 762 8322
e-mail address:	MSDSadvice@bp.com

15.2.5.2 Possible hazards

The preparation is classified as **hazardous** in accordance with Directive 1999/45/EC in its altered and adapted version.

Environmental hazards:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
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Sections (>>> 15.2.5.11 "Toxicological information" Page 188) and (>>> 15.2.5.12 "Ecological information" Page 188) contain more detailed information on health hazards, symptoms and environmental risks.

15.2.5.3 Composition / Information about the components

Chemical characterization:		Synthetic lubricant and additives.		
Chemical description	CAS no.	%	EINECS / ELINCS	Classification
Dithiocarbamic acid, dibutyl ester, methylene ester	10254-57-6	1 - 5	233-593-1	R52/53
Tridecanamine, n-tridecyl, branched, compounds with molybdenum hydroxide oxide (1:1)	280130-32-7	0.1 - 1	442-990-0	Xi; R41, R38 N; R50/53

Refer to Section (>>> 15.2.5.16 "Other information" Page 190) for the full text of the above R-phrases.

The occupational exposure limit values, where available, are specified in Section (>>> 15.2.5.8 "Exposure limits and personal protective equipment" Page 187).

15.2.5.4 First aid measures

Contact with eyes:	In case of contact, rinse eyes immediately with plenty of water for at least 15 minutes. If irritation occurs, consult a doctor.
Skin contact:	Wash affected areas of skin with soap and water, or use suitable cleaning agent. Change clothing and shoes if they become contaminated with product. Wash clothing before reuse. Clean shoes thoroughly before reuse. If irritation occurs consult a doctor.
Inhalation:	Take affected person into fresh air. Consult a doctor if symptoms persist.
Ingestion:	Do not induce vomiting unless explicitly directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this product have been swallowed, call a physician immediately.
Notes to physician:	Treatment should in general be symptomatic and directed at relieving any effects. Note regarding high-pressure applications. Injection into the skin due to contact with a product under high pressure constitutes a major medical emergency. Within a few hours the tissue swells up and becomes discolored and extremely painful, with severe subcutaneous necrosis. Surgical treatment is absolutely imperative. Comprehensive opening of the wound and the tissue beneath it is necessary in order to reduce tissue loss and to prevent or limit lasting damage. The high pressure can cause the product to penetrate extensive areas of tissue layers.

15.2.5.5 Fire-fighting measures

Suitable extinguishing agents:	In the event of a fire: use water spray (mist), foam, dry chemicals or CO ₂ . This substance is harmful to aquatic organisms. Extinguishing water contaminated with this product must be contained and prevented from entering surface waters or the sewage or drainage system.
Unsuitable extinguishing agents:	Do not use water jets.
Hazardous decomposition products:	The decomposition products may include the following materials: Carbon oxides Nitrogen oxides Sulfur oxides.
Unusual fire/explosion hazards:	This product is not inherently explosive in accordance with the applicable rules.
Special fire-fighting measures:	Not specified.
Protection of fire-fighters:	Fire-fighters must wear self-contained positive pressure breathing apparatus (SCBA) and full protective gear.

15.2.5.6 Measures after unintended release

Personal safety precautions:	No measures should be taken that involve a risk to personnel or have not been adequately trained. Evacuate the environment. Refuse access to personnel who are not required or are unprotected. Do not touch or step on any spilled substance. Avoid breathing in any spray or vapors. Ensure adequate ventilation. Where there is insufficient ventilation, wear suitable respiratory equipment. Use suitable protective equipment (see Section (>>> 15.2.5.8 "Exposure limits and personal protective equipment" Page 187)).
Environmental protection measures:	Prevent released material from dispersing or flowing away and from coming into contact with soil, surface waters and drainage system. Notify the relevant authorities if the product has caused pollution (sewers, surface waters, ground or air). Substance is a water pollutant.
Large spills:	Stop the leak if you can do so without risk. Remove container from spill area. Approach the spill area only with a following wind. Prevent entry into drainage system, surface waters, basements or confined areas. Flush spilled material into a wastewater treatment plant, or proceed as follows. Contain spilled material using a non-combustible absorbent (e.g. sand, soil, vermiculite, diatomaceous earth) and collect it in the designated containers for disposal in accordance with the local regulations (see Section (>>> 15.2.5.13 "Disposal information" Page 189)). Disposal should be entrusted to a recognized waste disposal company. Contaminated absorbents can be just as dangerous as spilled material. Note: See (>>> 15.2.5.1 "Designation of substance/formulation and manufacturer" Page 184) for contact in emergencies and (>>> 15.2.5.13 "Disposal information" Page 189) for disposal information.
Small spills:	Stop the leak if you can do so without risk. Remove container from spill area. Absorb spill with inert material and place it in a suitable container for disposal. Disposal should be entrusted to a recognized waste disposal company.

15.2.5.7 Handling and storage

Handling:	Spilled and leaked product must be prevented from coming into contact with soil and surface waters. Wash thoroughly after handling.
Storage:	Keep containers tightly sealed. Keep containers in a cool, well-ventilated area.
Germany - storage class:	10

15.2.5.8 Exposure limits and personal protective equipment

Ingredient name ACGIH TLVs:	Limit values to be monitored acc. to ACGIH (USA)
Base oil – unspecified	TWA: 5 mg/m ³ 8 hour(s). Form: mineral oil mist. STEL: 10 mg/m ³ 15 minute(s). Form: mineral oil mist.

The ACGIH values are enclosed for information and orientation purposes. Further information can be obtained from your supplier.

While this section contains specific OELs for individual components, different components may be contained in any mists, vapors or dusts that are generated. The specific OELs may thus not necessarily be applicable to the product as a whole and are merely provided for general information purposes.

Protective measures	
Limitation and monitoring of exposure in the workplace:	Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
Hygiene measures:	Wash hands, forearms and face thoroughly after handling chemical products and before eating, smoking or using the toilet, as well as at the end of the working day.

Personal protective equipment	
Respiratory protection:	Not essential. Sufficient ventilation is recommended in industry, however.
Hand protection:	Wear protective gloves if prolonged or repeated contact is likely. Chemical-resistant protective gloves. Recommended: nitrile gloves. The right choice of protective gloves is dependent on the chemicals to be handled, the working conditions, and the condition of the gloves themselves (even the best chemical-resistant protective gloves start to leak after repeated contact with chemicals). Most protective gloves only provide protection for a short period of time, after which they must be disposed of and replaced. As the specific working conditions and the chemicals concerned differ from case to case, appropriate safety measures must be developed for each individual application. Protective gloves should therefore be selected in consultation with the supplier/manufacturer, giving full consideration to the specific working conditions.
Eye protection:	Protective goggles with side shields to guard against splashing.
Skin and body:	Wear appropriate clothing to avoid prolonged skin contact.

15.2.5.9 Physical and chemical properties

General information / appearance	
Physical state:	Liquid.
Color:	Green.
Odor:	Light.

Important information on health, safety and the environment	
Flash point:	Open cup: 230°C (446°F) [Cleveland.]
Vapor pressure:	<0.01 kPa (<0.075 mm Hg) at 20 °C.
Viscosity:	Kinematic: 150 mm ² /s (150 cSt) at 40 °C.
Pour point:	-36 °C.
Density:	<1000 kg/m ³ (<1 g/cm ³) at 20 °C.
Solubility:	Insoluble in water.

15.2.5.10 Stability and reactivity

Stability:	The product is stable. No hazardous polymerization occurs under normal storage conditions and in normal use.
Conditions to be avoided:	No specific data.
Substances to be avoided:	Reactive or incompatible with the following substances: oxidizing materials.
Hazardous decomposition products:	The combustion products may include the following compounds: Carbon oxides Nitrogen oxides Sulfur oxides. No hazardous decomposition products should be formed under normal conditions of storage and use.

15.2.5.11 Toxicological information

Chronic toxicity:	
Chronic effects:	No particular effects or risks known.

Effects and symptoms	
Eyes:	May cause mild eye irritation.
Skin:	Prolonged or repeated contact can dry out the skin and lead to irritation and/or dermatitis.
Inhalation:	Vapors and spray mist may cause irritation of the mucous membranes of the nose and throat.
Ingestion:	Ingestion may cause gastrointestinal irritation and diarrhea.

15.2.5.12 Ecological information

Persistence / degradability:	Inherently biodegradable.
Mobility:	Non-volatile. Liquid. Insoluble in water.
Environmental hazards:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

15.2.5.13 Disposal information

Disposal information	
Waste specifications:	Generation of waste should be avoided or minimized if at all possible. Disposal of surplus material and products not suitable for recycling must be entrusted to a recognized waste disposal company. Disposal of this product and of its solutions and by-products must at all times comply with the environmental protection requirements, waste disposal legislation and the requirements of local authorities. Prevent released material from dispersing or flowing away and from coming into contact with soil, surface waters and drainage system.

Unused product	
European Waste Catalog (EWC):	13 02 06* Synthetic machine oils, gear oils and lubricating oils.

Use of the product for purposes other than those specified and/or impurities can necessitate the use of a different waste code number for the waste producer.

Packaging	
European Waste Catalog (EWC):	15 01 10* Packaging containing the residue of hazardous materials or contaminated by hazardous materials.

15.2.5.14 Transport information

Classification:	Not hazardous as defined by the transport regulations (ADR/ RID, ADNR, IMDG, ICAO/IATA).
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15.2.5.15 Regulations

Classification and labeling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Labeling requirements	
Risk (R) phrases:	R52/53 - Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety (S) phrases:	S61 - Avoid release to the environment. Refer to special instructions/safety data sheet.

Miscellaneous provisions	
Inventories:	European inventory: All components are listed or exempted. US inventory (TSCA 8b): All components are listed or exempted. Australian inventory (AICS): All components are listed or exempted. Canadian inventory: At least one component is not listed. Inventory of Existing Chemical Substances in China (IECSC): All components are listed or exempted. Japanese inventory of Existing and New Chemical Substances (ENCS): At least one component is not listed. Korean Existing Chemicals Inventory (KECI): All components are listed or exempted. Philippine Inventory of Chemicals and Chemical Substances (PICCS): All components are listed or exempted.
Classification acc. to the German Administrative Regulation on the Classification of Substances Hazardous to Water into Water Hazard Classes (VwVWS):	1, Annex no. 4.

15.2.5.16 Other information

List of R-phrases referred to in Section (->> 15.2.5.11 "Toxicological information" Page 188) and Section (->> 15.2.5.3 "Composition / Information about the components" Page 185)	R41 - Risk of serious damage to eyes. R38 - Irritating to skin. R50/53 - Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R52/53 - Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
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History	
Date of issue:	23/11/2007.
Date of previous issue:	L31/08/2007.
Created by:	Product Stewardship Group.

Notes for the reader

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as at the date of issue specified below. No warranty or representation, express or implied, is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given are valid if the product is sold for the application(s) specified. The product should not be used for purposes other than the applications specified without prior consultation with us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations.

The BP Group accepts no responsibility for any damage or injury resulting from uses other than the stated product use of the material, from any failure to adhere to recommendations, or from hazards inherent in the nature of the material. Those purchasing the product for supply to third parties for use at work have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information on this data sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

16 KUKA Service

16.1 Requesting support

Introduction	The KUKA Roboter GmbH documentation offers information on operation and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.
Information	The following information is required for processing a support request: ■ Model and serial number of the robot ■ Model and serial number of the controller ■ Model and serial number of the linear unit (if applicable) ■ Model and serial number of the linear unit (if applicable) ■ Version of the KUKA System Software ■ Optional software or modifications ■ Archive of the software For KUKA System Software V8: instead of a conventional archive, generate the special data package for fault analysis (via KrcDiag). ■ Application used ■ Any external axes used ■ Description of the problem, duration and frequency of the fault

16.2 KUKA Customer Support

Availability	KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.
Argentina	Ruben Costantini S.A. (Agency) Luis Angel Huergo 13 20 Parque Industrial 2400 San Francisco (CBA) Argentina Tel. +54 3564 421033 Fax +54 3564 428877 ventas@costantini-sa.com
Australia	Headland Machinery Pty. Ltd. Victoria (Head Office & Showroom) 95 Highbury Road Burwood Victoria 31 25 Australia Tel. +61 3 9244-3500 Fax +61 3 9244-3501 vic@headland.com.au www.headland.com.au

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Controller Option

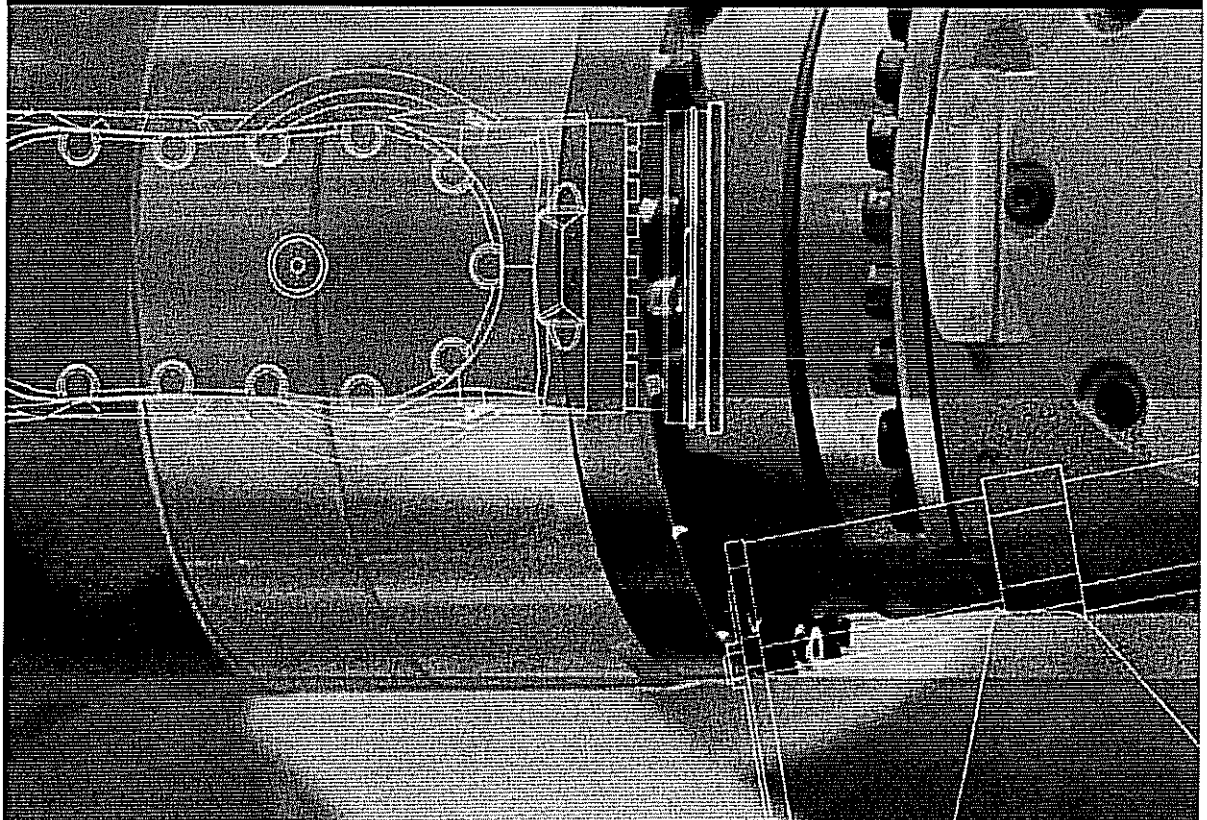
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Isolating Transformer Installation Kit

For KR C4 and KR C4 CK

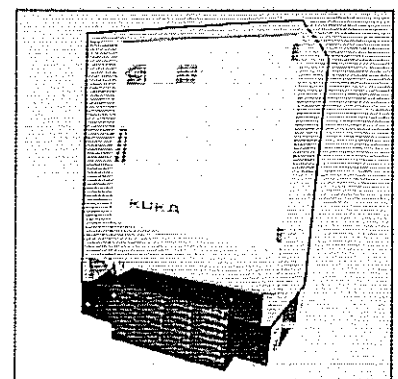
For KR C4 midsize and KR C4 midsize CK

Assembly and Operating Instructions



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Version: MA KR C4 midsize Trafo attachment kit V1 en (PDF)



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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

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1 Introduction

1.1 Industrial robot documentation

The industrial robot documentation consists of the following parts:

- ▣ Documentation for the manipulator
- ▣ Documentation for the robot controller
- ▣ Operating and programming instructions for the KUKA System Software
- ▣ Documentation relating to options and accessories
- ▣ Parts catalog on storage medium

Each of these sets of instructions is a separate document.

1.2 Representation of warnings and notes

Safety

These warnings are relevant to safety and **must** be observed.

 **DANGER** These warnings mean that it is certain or highly probable that death or severe injuries **will** occur, if no precautions are taken.

 **WARNING** These warnings mean that death or severe injuries **may** occur, if no precautions are taken.

 **CAUTION** These warnings mean that minor injuries **may** occur, if no precautions are taken.

 **NOTICE** These warnings mean that damage to property **may** occur, if no precautions are taken.

 These warnings contain references to safety-relevant information or general safety measures.
These warnings do not refer to individual hazards or individual precautionary measures.

This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

 **Exact instructions** Procedures marked with this warning **must** be followed exactly.

Notes

These hints serve to make your work easier or contain references to further information.

 **i** Tip to make your work easier or reference to further information.

2 Purpose

2.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- ≡ Advanced knowledge of electrical and electronic systems
- ≡ Advanced knowledge of the robot controller
- ≡ Advanced knowledge of the Windows operating system



For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

2.2 Intended use

Use

The isolating transformer installation kit is used as a power source for KR C4 and KR C4 midsize robot controllers. For robot systems for which the "supply voltage without transformer" option is not available or for power supply systems without a grounded neutral, the voltages are as follows:

- ≡ 380 V
- ≡ 400 V
- ≡ 440 V
- ≡ 480 V
- ≡ 575 V

The transformer ensures the electrical isolation of the primary and secondary sides.

Misuse

Any use or application deviating from the intended use is deemed to be misuse; examples of such misuse include:

- ≡ Operation outside the permissible operating parameters
- ≡ Use in potentially explosive environments
- ≡ Underground operation

3 Product description

3.1 Overview of the industrial robot

The industrial robot consists of the following components:

- Manipulator
- Robot controller
- Isolating transformer installation kit
- Teach pendant
- Connecting cables
- Software
- Options, accessories

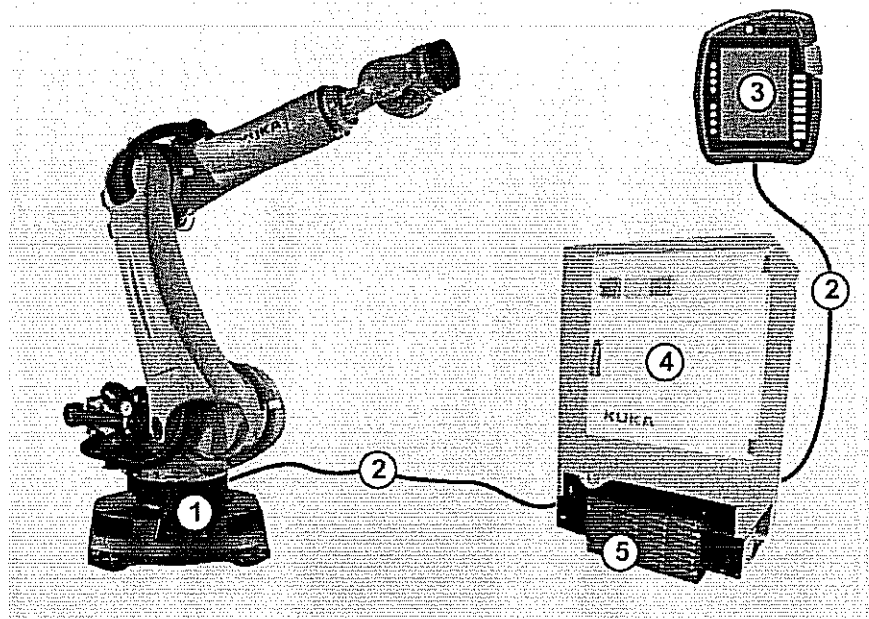


Fig. 3-1: Overview of the industrial robot

- | | |
|---------------------|--|
| 1 Manipulator | 4 Robot controller |
| 2 Connecting cables | 5 Isolating transformer installation kit |
| 3 Teach pendant | |

3.2 Overview of the isolating transformer installation kit

Description

The transformer is installed in a separate housing under the robot controller. The transformer contains a temperature switch which signals to the robot controller if the winding temperature exceeds the permitted limit.

The isolating transformer installation kit consists of the following components:

- Transformer
- Transformer housing
- Terminal box
- Fork slots
- Primary fusing Q1/Q7
- Secondary fusing Q3

■ Set of rollers

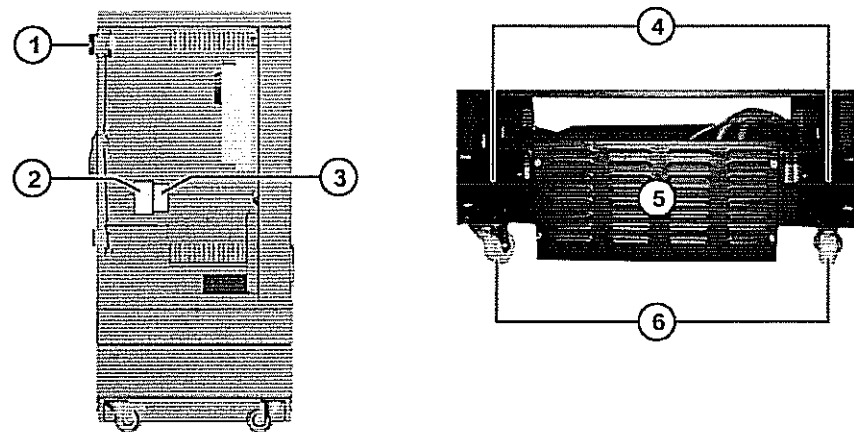


Fig. 3-2: Overview of transformer

- 1 Main switch (for KR C4 NA: Primary fusing Q1)
- 2 Power circuit-breakers Q3/Q7
- 3 Terminal strip XT1
- 4 Fork slots
- 5 Transformer housing
- 6 Set of rollers

3.3 Protective circuit

Description

In compliance with the EMC Directive, all cables with their ground conductors and shields are connected to the ground of the robot controller. Ground terminals are provided in the robot controller and in the transformer housing. Ground conductor terminals are available on all terminal strips.

The transformer housing and the terminal box are connected to the protective circuit by means of ground terminals. The ground conductor terminals of terminal strip XT1 are connected to the PE rail of the control controller.



The connections of the ground terminals and/or ground conductor terminals must not be loosened or removed. Check them regularly to ensure that they are securely fastened.

4 Technical data

4.1 Basic data

8 kVA

Article number	00-111-256
Rated power	7.3/8 kVA+0.5 kVA 80% D.C. (0.5 kVA with D.C. 50%)
Input voltage	380 V AC (for optional transformer 8 kVA 380 V; Article number 00-220-585) 400 V AC (for optional transformer 8 kVA 400 V; Article number 00-220-586)
Output voltage	SEC1: 3AC 400 V SEC2: 1AC 230 V
Vector group	Yyn0v
Ambient temperature	55 °C
Insulation class	H
Specifications	EN61558
Miscellaneous	Temperature switch 180 °C (break contact)
Primary fusing EU (Q7)	3RV2021-4BA10 (external) Set value 14 A
Primary fusing NA (Q1)	140U-H2C3-C15 (external) Set value 15 A
Secondary fusing (SEC1) (Q3)	3RV2021-4BA10 (external) Set value 14 A

Article number	00-111-258
Rated power	7.3/8 kVA+0.5 kVA 80% D.C. (0.5 kVA with D.C. 50%)
Input voltage	440 V AC (for optional transformer 8 kVA 440 V; Article number 00-220-587) 480 V AC (for optional transformer 8 kVA 480 V; Article number 00-220-588) 575 V AC (for optional transformer 8 kVA 575 V; Article number 00-220-589)
Output voltage	SEC1: 3AC 400 V SEC2: 1AC 110 V
Vector group	Yyn0v
Ambient temperature	55 °C
Insulation class	H
Specifications	EN61558
Miscellaneous	Temperature switch 180 °C (break contact)
Primary fusing EU (Q7)	3RV2021-4BA10 (external) Set value 14 A

Primary fusing NA (Q1)	140U-H2C3-C15 (external) Set value 15 A
Secondary fusing (SEC1) (Q3)	3RV2021-4BA10 (external) Set value 14 A

13 kVA

Article number	00-111-255
Rated power	11.0/13 kVA+0.5 kVA 70% D.C. (0.5 kVA with D.C. 50%)
Input voltage	380 V AC (for optional transformer 13 kVA 380 V; Article number 00-220-590) 400 V AC (for optional transformer 13 kVA 400 V; Article number 00-220-591)
Output voltage	SEC1: 3AC 400 V SEC2: 1AC 230 V
Vector group	Yyn0v
Ambient temperature	55 °C
Insulation class	H
Specifications	EN61558
Miscellaneous	Temperature switch 180 °C (break contact)
Primary fusing EU (Q7)	3RV2021-4DA10 (external) Set value 24 A
Primary fusing NA (Q1)	140U-H2C3-C20 (external) Set value 20 A
Secondary fusing (SEC1) (Q3)	3RV2021-4DA10 (external) Set value 24 A

Article number	00-111-257
Rated power	11.0/13 kVA+0.5 kVA 70% D.C. (0.5 kVA with D.C. 50%)
Input voltage	440 V AC (for optional transformer 13 kVA 440 V; Article number 00-220-592) 480 V AC (for optional transformer 13 kVA 480 V; Article number 00-220-593) 575 V AC (for optional transformer 13 kVA 575 V; Article number 00-220-594)
Output voltage	SEC1: 3AC 400 V SEC2: 1AC 110 V
Vector group	Yyn0v
Ambient temperature	55 °C
Insulation class	H
Specifications	EN61558
Miscellaneous	Temperature switch 180 °C (break contact)

Primary fusing EU (Q7)	3RV2021-4DA10 (external) Set value 24 A
Primary fusing NA (Q1)	140U-H2C3-C20 (external) Set value 20 A
Secondary fusing (SEC1) (Q3)	3RV2021-4DA10 (external) Set value 24 A

Vibration resistance

Type of loading	During transportation	During continuous operation
r.m.s. acceleration (sustained oscillation)	0.37 g	0.1 g
Frequency range (sustained oscillation)	4 to 120 Hz	
Acceleration (shock in X/Y/Z direction)	10 g	2.5 g
Waveform/duration (shock in X/Y/Z direction)	Half-sine/11 ms	

4.2 Dimensions of the KR C4 transformer

The dimensions of the transformer housing with fork slots are shown in the diagram (>>> Fig. 4-1).

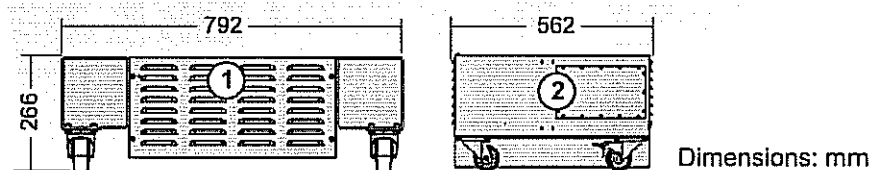


Fig. 4-1: Dimensions

- 1 Front view
- 2 Side view

5 Safety

This documentation contains safety instructions which refer specifically to the product described here. The fundamental safety information for the industrial robot can be found in the "Safety" chapter of the operating or assembly instructions for the robot controller.

 WARNING	The "Safety" chapter in the operating instructions or assembly instructions of the robot controller must be observed. Death to persons, severe injuries or considerable damage to property may otherwise result.
--	--

6 KUKA Service

6.1 Requesting support

Introduction The KUKA Roboter GmbH documentation offers information on operation and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.

Information The following information is required for processing a support request:

- Model and serial number of the robot
- Model and serial number of the controller
- Model and serial number of the linear unit (if applicable)
- Model and serial number of the energy supply system (if applicable)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software

For KUKA System Software V8: instead of a conventional archive, generate the special data package for fault analysis (via **KrcDiag**).

- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

6.2 KUKA Customer Support

Availability KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.

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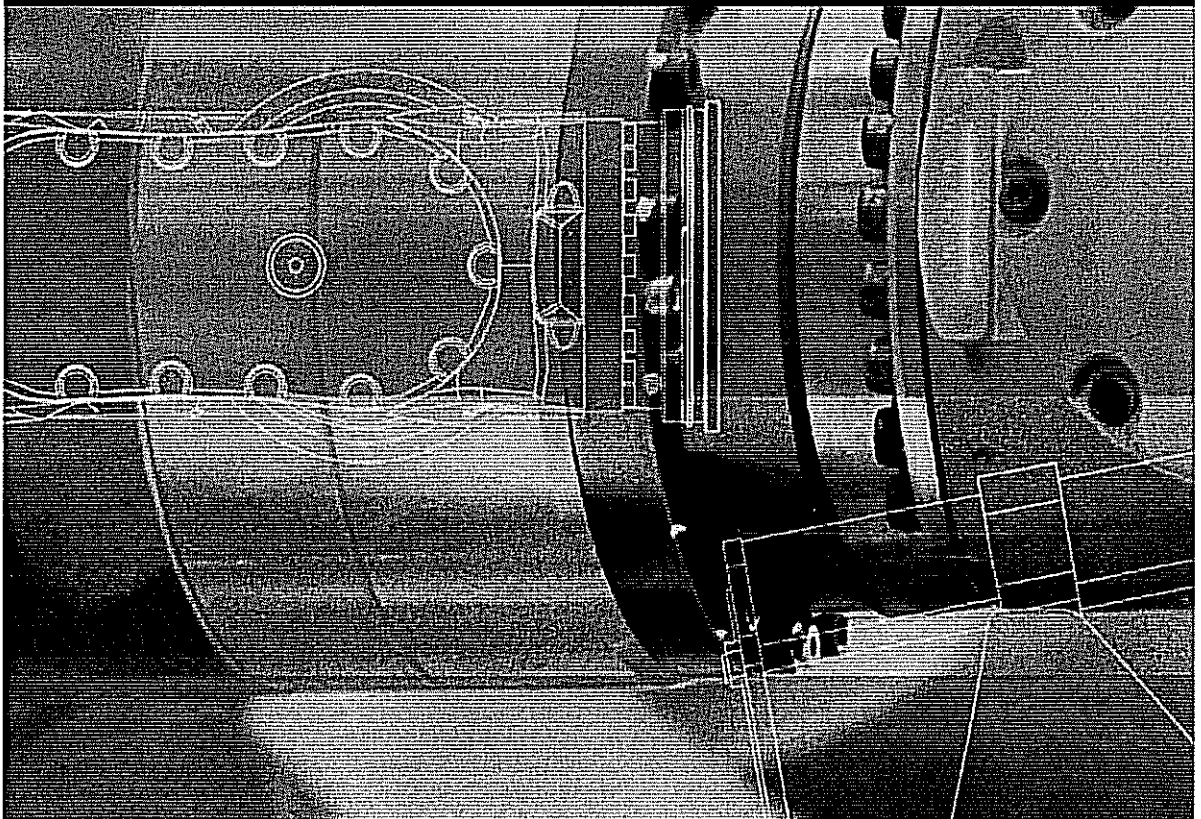
KUKA

Controller

KUKA Roboter GmbH

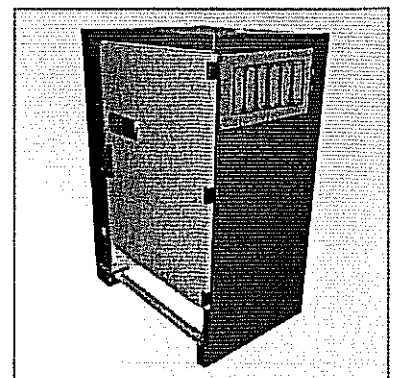
KR C4 midsize

Operating Instructions



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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

Translation of the original documentation

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1 Introduction

1.1 Industrial robot documentation

The industrial robot documentation consists of the following parts:

- ▣ Documentation for the manipulator
- ▣ Documentation for the robot controller
- ▣ Operating and programming instructions for the KUKA System Software
- ▣ Documentation relating to options and accessories
- ▣ Parts catalog on storage medium

Each of these sets of instructions is a separate document.

1.2 Representation of warnings and notes

Safety

These warnings are relevant to safety and **must** be observed.

	These warnings mean that it is certain or highly probable that death or severe physical injury will occur, if no precautions are taken.
	These warnings mean that death or severe physical injury may occur, if no precautions are taken.
	These warnings mean that minor physical injuries may occur, if no precautions are taken.
	These warnings mean that damage to property may occur, if no precautions are taken.
	These warnings contain references to safety-relevant information or general safety measures. These warnings do not refer to individual hazards or individual precautionary measures.

Notes

These hints serve to make your work easier or contain references to further information.

	Tip to make your work easier or reference to further information.
---	---

1.3 Trademarks

Windows is a trademark of Microsoft Corporation.



is a trademark of Beckhoff Automation GmbH.

1.4 Terms used

Term	Description
CCU	Cabinet Control Unit
CIB	Cabinet Interface Board

Term	Description
CSP	Controller System Panel. Display element and connection point for USB and network
Dual NIC card	Dual network card
EDS	Electronic Data Storage (memory card)
EMD	Electronic Mastering Device
EMC	Electromagnetic compatibility
KCB	KUKA Controller Bus
KCP	The KCP (KUKA Control Panel) teach pendant has all the operator control and display functions required for operating and programming the industrial robot. The KCP variant for the KR C4 is called KUKA smartPAD. The general term "KCP", however, is generally used in this documentation.
KEB	KUKA Extension Bus
KLI	KUKA Line Interface. Connection to higher-level control infrastructure (PLC, archiving)
KOI	KUKA Operator Panel Interface
KPC	Control PC
KPP	KUKA Power Pack (drive power supply with drive controller)
KRL	KUKA Robot Language
KSB	KUKA System Bus. Internal KUKA bus for internal networking of the controllers with each other
KSI	KUKA Service Interface
KSP	KUKA Servo Pack (drive controller)
KSS	KUKA System Software
Manipulator	The robot arm and the associated electrical installations
RDC	Resolver digital converter.
SATA connections	Data bus for exchanging data between the processor and the hard drive
SG FC	Servo Gun
SIB	Safety Interface Board
SOP	
US1	Load voltage (24 V) not switched
US2	Load voltage (24 V) switched. Deactivates actuators, for example, when the drives are deactivated
USB	Universal Serial Bus. Bus system for connecting additional devices to a computer
EA	External axis (linear unit, Posiflex)

2 Purpose

2.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of electrical and electronic systems
- Advanced knowledge of the robot controller
- Advanced knowledge of the Windows operating system



For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

2.2 Intended use

Use

The robot controller is intended solely for operating the following components:

- KUKA industrial robots
- KUKA linear units
- KUKA positioners

Impermissible misuse

Any use or application deviating from the intended use is deemed to be impermissible misuse; examples of such misuse include:

- Transportation of persons and animals
- Use as a climbing aid
- Operation outside the permissible operating parameters
- Use in potentially explosive environments

3 Product description

3.1 Overview of the industrial robot

The industrial robot consists of the following components:

- ▣ Manipulator
- ▣ Robot controller
- ▣ Teach pendant
- ▣ Connecting cables
- ▣ Software
- ▣ Options, accessories

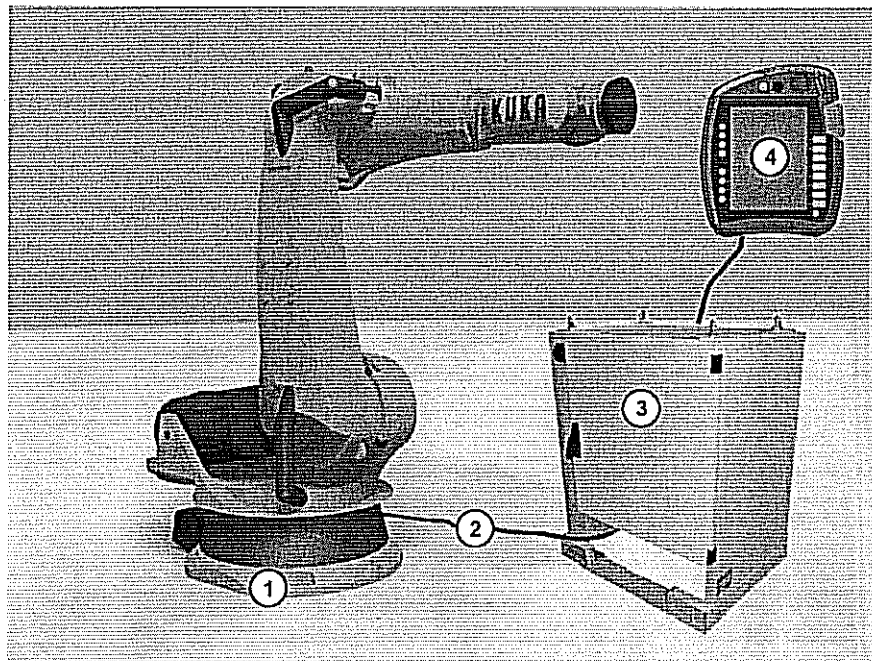


Fig. 3-1: Example of an industrial robot

- | | |
|---------------------|--------------------|
| 1 Manipulator | 3 Robot controller |
| 2 Connecting cables | 4 Teach pendant |

3.2 Overview of the robot controller

The robot controller consists of the following components:

- ▣ Control PC (KPC)
- ▣ Low-voltage power supply unit
- ▣ Drive power supply with drive controller: KUKA Power Pack (KPP)
- ▣ Drive controller: KUKA Servo Pack (KSP)
- ▣ Teach pendant (KUKA smartPAD)
- ▣ Cabinet Control Unit (CCU)
- ▣ Controller System Panel (CSP)
- ▣ Safety Interface Board (SIB)
- ▣ Fuse elements
- ▣ Batteries
- ▣ Fans
- ▣ Connection panel

■ Set of rollers (optional)

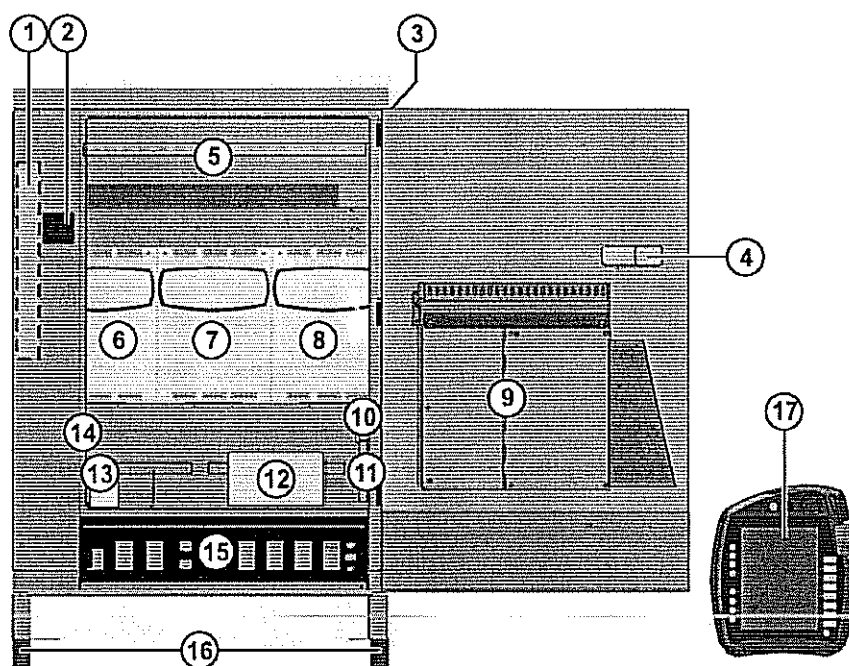


Fig. 3-2: Overview of robot controller, front view

- | | |
|--|------------------------------|
| 1 Mains filter | 10 Brake filter |
| 2 Main switch | 11 CCU |
| 3 Side connection panel | 12 SIB/Extended SIB |
| 4 CSP | 13 Batteries |
| 5 Space for integration of options | 14 Fuse elements |
| 6 Drive controller for axes 1 to 3 | 15 Lower connection panel |
| 7 Drive controller for axes 4 to 6 | 16 Set of rollers (optional) |
| 8 Drive power supply (drive controller for axes 7 and 8, optional) | 17 KUKA smartPAD |
| 9 Control PC | |

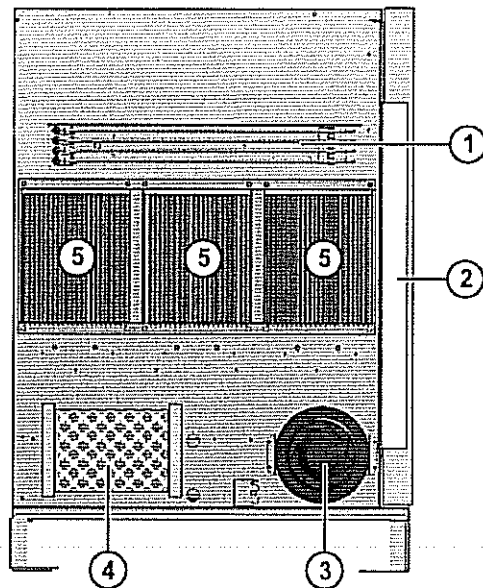


Fig. 3-3: Overview of robot controller, rear view

- | | |
|--------------------|---------------------------------|
| 1 Ballast resistor | 4 Low-voltage power supply unit |
| 2 Heat exchanger | 5 KPP and KSP heat sinks |
| 3 External fan | |

3.3 KUKA Power Pack

Description

The KUKA Power Pack (KPP) is the drive power supply and generates a rectified intermediate circuit voltage from an AC power supply. This intermediate circuit voltage is used to supply the internal drive controllers and external drives. There are 4 different device variants, all having the same size. There are LEDs on the KPP which indicate the operating state.

- KPP without axis amplifier (KPP 600-20)
- KPP with amplifier for one axis (KPP 600-20-1x40)
Peak output current 1x40 A
- KPP with amplifier for two axes (KPP 600-20-2x40)
Peak output current 2x40 A
- KPP with amplifier for one axis (KPP 600-20-1x64)
Peak output current 64 A

Functions

The KPP has the following functions:

- KPP central AC power supply connection in interconnected operation
- Power output with 400 V supply voltage: 14 kW
- Rated current: 25 A DC
- Connection and disconnection of the supply voltage
- Powering of several axis amplifiers from the DC link
- Integrated brake chopper through connection of an external ballast resistor
- Overload monitoring by the ballast resistor
- Stopping of synchronous servomotors by means of short-circuit braking

3.4 KUKA Servo Pack

Description	The KUKA Servo Pack (KSP) is the drive controller for the manipulator axes. There are 3 different device variants, all having the same size. There are LEDs on the KSP which indicate the operating state. ■ KSP for 3 axes (KSP 600-3x40) Peak output current 3x 40 A ■ KSP for 3 axes (KSP 600-3x64) Peak output current 3x 64 A ■ KSP for 3 axes (KSP 600-3x20) Peak output current 3x 20 A
Functions	The KSP has the following functions: ■ Power range: 11 kW to 14 kW per axis amplifier ■ Direct infeed of the DC intermediate circuit voltage ■ Field-oriented control for servomotors: Torque control

3.5 Control PC

Components	The control PC (KPC) includes the following components: ■ Motherboard ■ Processor ■ Memory modules ■ Hard drive ■ LAN Dual NIC network card ■ PC fan ■ Optional modules, e.g. field bus cards
Functions	The control PC (KPC) is responsible for the following functions of the robot controller: ■ User interface ■ Program creation, correction, archiving, and maintenance ■ Sequence control ■ Path planning ■ Control of the drive circuit ■ Monitoring ■ Safety equipment ■ Communication with external periphery (other controllers, host computers, PCs, network)

3.6 Cabinet Control Unit

Description	The Cabinet Control Unit (CCU) is the central power distributor and communication interface for all components of the robot controller. The CCU consists of the Cabinet Interface Board (CIB) and the Power Management Board (PMB). All data are transferred via this internal communication interface to the controller for further processing. If the mains voltage fails, the control components continue to be powered by batteries until the position data are saved and the controller has shut down. The charge and quality of the batteries are checked by means of a load test.
Functions	■ Communication interface for the components of the robot controller

- Safe inputs and outputs
 - Control of main contactors 1 and 2
 - Mastering test
 - KUKA smartPAD plugged in
 - 6 Fast Measurement inputs for customer applications
 - Monitoring of the fans in the robot controller
 - External fan
 - Control PC fan
 - Temperature sensing:
 - Thermostatic switch for transformer
 - Alarm contact for cooling unit
 - Alarm contact for main switch
 - Temperature sensor for ballast resistor
 - Temperature sensor for internal cabinet temperature
 - The following components are connected to the KPC via the KUKA Controller Bus:
 - KPP/KSP
 - Resolver digital converter
 - The following operator panels and service devices are connected to the control PC via the KUKA System Bus:
 - KUKA Operator Panel Interface
 - KUKA Line Interface
 - Diagnostic LEDs
 - Electronic Data Storage Interface
- Power supply with battery backup**
- KPP
 - KSP
 - KUKA smartPAD
 - Control PC multicore
 - Controller System Panel (CSP)
 - Resolver Digital Converter (RDC)
 - Standard SIB or Standard and Extended SIB
- Power supply without battery backup**
- Motor brakes
 - External fan
 - Customer interface

3.7 Safety Interface Board

Description The Safety Interface Board (SIB) is an integral part of the safe customer interface. 2 different SIBs are used in the robot controller, the Standard SIB and the Extended SIB, depending on the configuration of the customer interface. Each of the 2 boards can be operated on its own or jointly with the other one. The Standard SIB and the Extended SIB essentially incorporate sensing, control and switching functions. The output signals are provided as electrically isolated outputs.

The Standard SIB contains the following safe inputs and outputs:

- 5 safe inputs
- 3 safe outputs

The Extended SIB contains the following safe inputs and outputs:

- ≡ 8 safe inputs
- ≡ 8 safe outputs

Functions

The Standard SIB has the following functions:

- ≡ Safe inputs and outputs for the digital safety interface X11 (XD211)

The Extended SIB has the following functions:

- ≡ Safe inputs and outputs for range selection and range monitoring for the SafeRobot option

or optionally

- ≡ Provision of signals for axis range monitoring

3.8 Resolver Digital Converter

Description

The Resolver Digital Converter (RDC) is used to detect the motor position data. 8 resolvers can be connected to the RDC. In addition, the motor temperatures are measured and evaluated. For non-volatile data storage, the EDS is located in the RDC box.

The RDC is mounted in an RDC box on the base frame of the manipulator.

Functions

The RDC has the following functions:

- ≡ Safe acquisition of up to 8 motor position data streams via resolver
- ≡ Detection of up to 8 motor operating temperatures
- ≡ Communication with the robot controller
- ≡ Monitoring of the resolver cables
- ≡ The following non-volatile data are stored on the EDS:
 - ≡ Position data
 - ≡ KUKA configuration

3.9 Controller System Panel

Description

The Controller System Panel (CSP) is a display element for the operating state and has the following connections:

- ≡ USB1
- ≡ USB2
- ≡ KLI (optional)

Overview

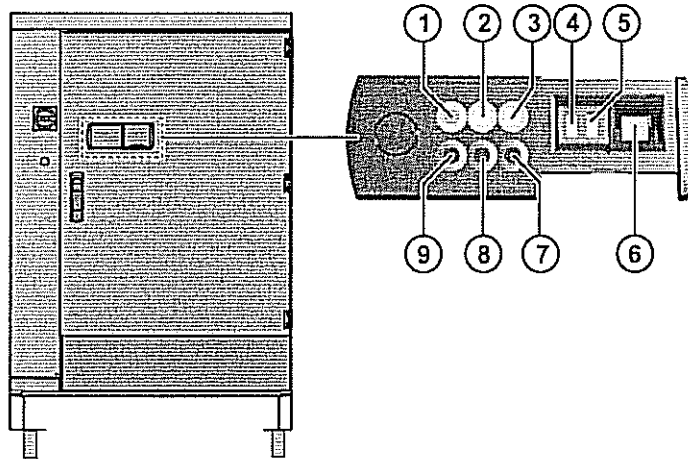


Fig. 3-4: Arrangement of LEDs and connectors on CSP

Item	Component	Color	Meaning
1	LED 1	Green	Operating LED
2	LED 2	White	Sleep LED
3	LED 3	White	Automatic LED
4	USB 1	-	-
5	USB 2	-	-
6	RJ45	-	KLI
7	LED 6	Red	Error LED 3
8	LED 5	Red	Error LED 2
9	LED 4	Red	Error LED 1

3.10 Low-voltage power supply unit

Description

The low-voltage power supply unit provides power to the components of the robot controller.

A green LED indicates the operating state of the low-voltage power supply unit.

3.11 24 V external power supply

External 24 V power supply is possible via the following interfaces:

- RoboTeam X57
If power is supplied externally and the controller is switched off, the SIB is in the fail-safe state.
- Interface X11
- Connector X55
Power supply to the KLI switch in the robot controller.

The external power supply to the SIB and CIB boards cannot be isolated. If the SIB is supplied externally, the CIB is also supplied externally, and vice versa.

3.12 Batteries

Description

In the event of a power failure, or if the power is switched off, the batteries enable the robot controller to be shut down in a controlled manner. The batteries are charged via the CCU and the charge is checked and indicated.

3.13 Mains filter

Description The mains filter (interference suppressor filter) suppresses interference voltages on the power cable.

3.14 Bus devices

Overview

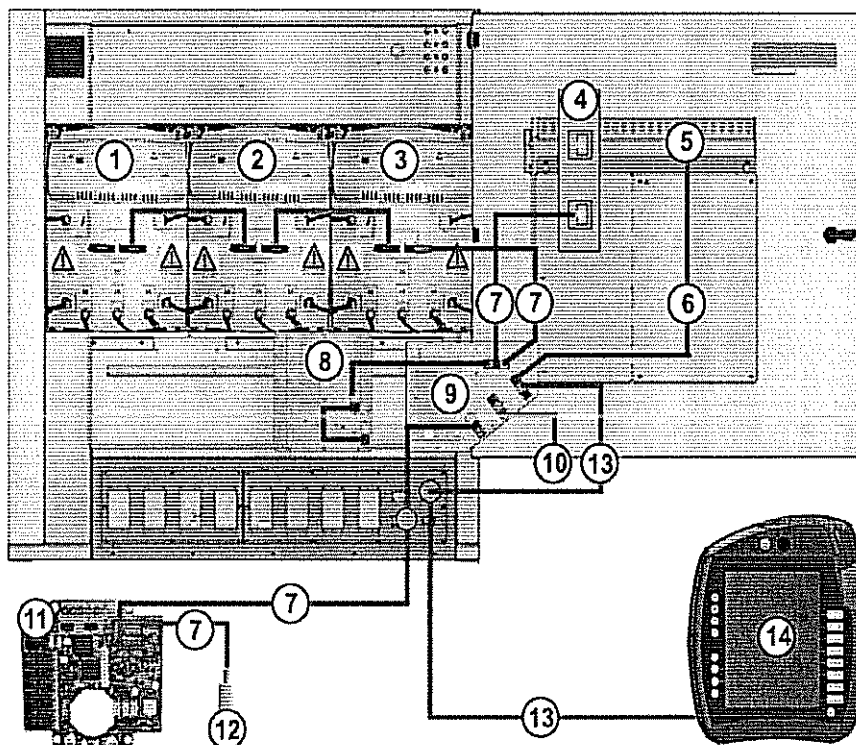


Fig. 3-5: Overview of bus devices

- | | |
|-----------------------------|--------------------------------------|
| 1 KSP, left | 8 Standard/Extended SIB |
| 2 KSP, middle | 9 CCU |
| 3 KPP | 10 KUKA Extension Bus (KEB) |
| 4 Dual NIC card | 11 RDC |
| 5 Ethernet motherboard | 12 Electronic Mastering Device (EMD) |
| 6 KUKA System Bus (KSB) | 13 OPI |
| 7 KUKA Controller Bus (KCB) | 14 KUKA smartPAD |

3.14.1 KCB devices and configuration variants

KCB devices The KCB includes the following devices:

- ≡ KPP
- ≡ KSP, middle
- ≡ KSP, left
- ≡ RDC
- ≡ CIB
- ≡ EMD

Configuration variants

Application	Config.	EMD	RDC	SG FC	KSP, middle	KSP, left	KPP
KR without EA	Variant 1	X	X	-	KSP3x40	KSP3x40/64	KPP 0
KR with EA	Variant 2	X	X	-	KSP3x40	KSP3x40/64	KPP 1
KR with 2 EA	Variant 3	X	X	X	KSP3x40	KSP3x40/64	KPP 2
KR with SG without EA	Variant 4	X	X	X	KSP3x40	KSP3x40/64	KPP 1
KR with 2 SG or 1 SG and 1 EA	Variant 5	X	X	-	KSP3x40	KSP3x40/64	KPP 2

3.14.2 KSB devices and configuration variants

KSB devices The KSB includes the following devices:

- ▣ CIB SION
- ▣ KCP SION
- ▣ Standard SIB
- ▣ Extended SIB

Configuration variants

Application	Config.	CIB	Standard SIB	Extended SIB
Standard Safety without/with SOP via PROFIsafe	Variant 1	X	-	-
Standard Safety via interface	Variant 2	X	X	-
Standard Safety with SOP via interface	Variant 3	X	X	X

3.14.3 KEB devices and configuration variants

KEB devices The KEB includes the following devices:

- ▣ PROFIBUS master
- ▣ PROFIBUS slave
- ▣ PROFIBUS master/slave
- ▣ Expansion of digital I/Os 16/16
- ▣ DeviceNet master
- ▣ DeviceNet slave
- ▣ DeviceNet master/slave
- ▣ Digital I/Os 16/16
- ▣ Digital I/Os 16/16/4
- ▣ Digital I/Os 32/32/4

Configuration variants

Application	Config.	Bus
Connection of PROFIBUS devices	Variant 1	PROFIBUS master
Connection to line PLC with PROFIBUS interface	Variant 2	PROFIBUS slave

Application	Config.	Bus	
Connection of PROFIBUS devices Connection to line PLC with Profibus interface	Variant 3	PROFIBUS master/slave	
Connection of PROFIBUS devices Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A	Variant 4	PROFIBUS master	Expansion of digital I/Os 16/16
Connection to line PLC with PROFIBUS interface Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A	Variant 5	PROFIBUS slave	
Connection of PROFIBUS devices Connection to line PLC with PROFIBUS interface Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A	Variant 6	PROFIBUS master/slave	
Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A	Variant 7	Digital I/Os 16/16	
Connection of 16 dig. inputs and 16 dig. outputs with 0.5/2 A	Variant 8	Digital I/Os 16/16/4	
Connection of 32 dig. inputs and 32 dig. outputs with 0.5/2 A	Variant 9	Digital I/Os 32/32/4	
VKR C2-compatible interface for connection to line PLC	Variant 10	Retrofit	
Connection of EtherCAT devices	Variant 11	-	
Connection of DeviceNet devices	Variant 12	DeviceNet master	
Connection to line PLC with DeviceNet interface	Variant 13	DeviceNet slave	
Connection of DeviceNet devices Connection to line PLC with DeviceNet interface	Variant 14	DeviceNet master/slave	
Connection of DeviceNet devices Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A.	Variant 15	DeviceNet master	Expansion of digital I/Os 16/16
Connection to line PLC with DeviceNet interface Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A.	Variant 16	DeviceNet slave	
Connection of DeviceNet devices Connection to line PLC with DeviceNet interface Connection of 16 dig. inputs and 16 dig. outputs with 0.5 A.	Variant 17	DeviceNet master/slave	

In the following cases a system modification must be carried out by the customer using WorkVisual after connecting customer-specific devices to the corresponding interfaces:

- Connection of PROFIBUS devices
- Connection of EtherCAT devices

3.15 Interfaces

Note

The following safety interfaces can be configured in the robot controller:

- Discrete interface X11
- PROFIsafe KLI interface X66



The discrete interface X11 and the PROFIsafe interface cannot be connected and used together. Only one of the two interfaces can be used at a time.

Overview

The connection panel of the robot controller consists of connections for the following cables:

- Power cable / infeed
- Motor cables to the manipulator
- Data cables to the manipulator
- KUKA smartPAD cable
- PE cables
- Peripheral cables

The configuration of the connection panel varies according to the customer-specific version and the options required.

Lower connection panel

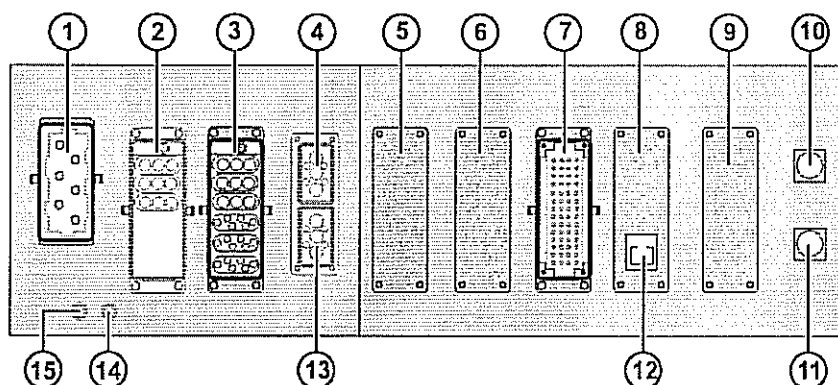


Fig. 3-6: Lower connection panel, overview

- 1 XS1 Power supply connection
- 2 Slot 1 (>>> "Assignment of slot 1" Page 22)
- 3 Slot 2 (>>> "Assignment of slot 2" Page 22)
- 4 X7.1 Motor connection for external axis 7 (optional)
- 5 Optional
- 6 Optional
- 7 X11 interface
- 8 Optional
- 9 Optional
- 10 X19 smartPAD connection
- 11 X21 RDC connection
- 12 X66 PROFIsafe KLI interface
- 13 X7.2 Motor connection for external axis 8 (optional)
- 14 PE1 Ground conductor to manipulator
- 15 PE2 Ground conductor to main infeed



Only interface X11 or the PROFIsafe interface X66 can be configured.

Assignment of slot 1

Slot 1 can be assigned the following motor connections:

- X20.1 Motor connector, heavy-duty robot, axes 1-3
- X8 Motor connector, heavy-duty palletizing robot, axes 1-3 and 6

Assignment of slot 2

Slot 2 can be assigned the following motor connections:

- X20 Motor connector, axes 1-6
- X20.4 Motor connector, heavy-duty robot, axes 4-6
- X20.4 Motor connector, heavy-duty palletizing robot, axes 5 and 6



The optional interfaces in the connection panel are described in the assembly and operating instructions "Optional Interfaces for KR C4".

Upper side connection panel

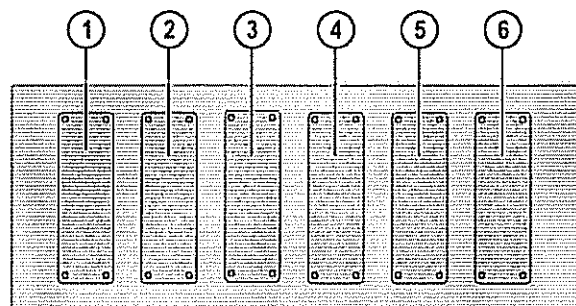


Fig. 3-7: Upper side connection panel, overview

- 1 Slot 11
- 2 Slot 12
- 3 Slot 13
- 4 Slot 14
- 5 Slot 15
- 6 Slot 16



All contactor, relay and valve coils that are connected to the robot controller by the user must be equipped with suitable suppressor diodes. RC elements and VCR resistors are not suitable.



The optional interfaces in the upper side connection panel are described in the assembly and operating instructions "Optional Interfaces for KR C4 midsize".

3.16 KUKA smartPAD holder (optional)

Description

The optional KUKA smartPAD holder can be used to hang up the smartPAD and its connecting cable on the door of the robot controller or on the safety fence.

Overview

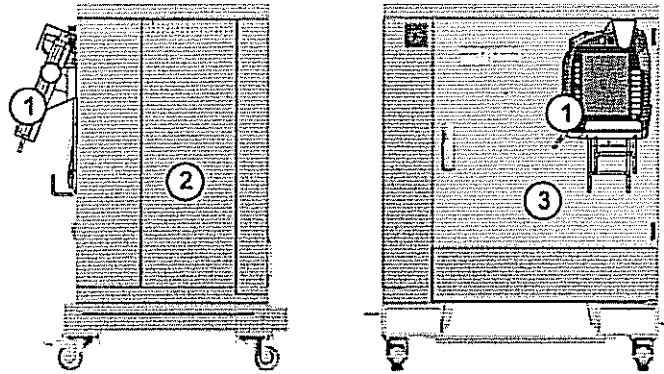


Fig. 3-8: KUKA smartPAD holder

- | | |
|------------------------|--------------|
| 1 KUKA smartPAD holder | 3 Front view |
| 2 Side view | |

3.17 Cabinet cooling

Description

The control cabinet is divided into two cooling circuits. The inner zone, containing the control and power electronics, is cooled by a heat exchanger. In the outer zone, the ballast resistor and the heat sinks of the KPP and KSP are cooled directly by ambient air.

NOTICE Upstream installation of filter mats at the ventilation slits causes an increase in temperature, leading to a reduction in the service life of the installed devices!

Configuration

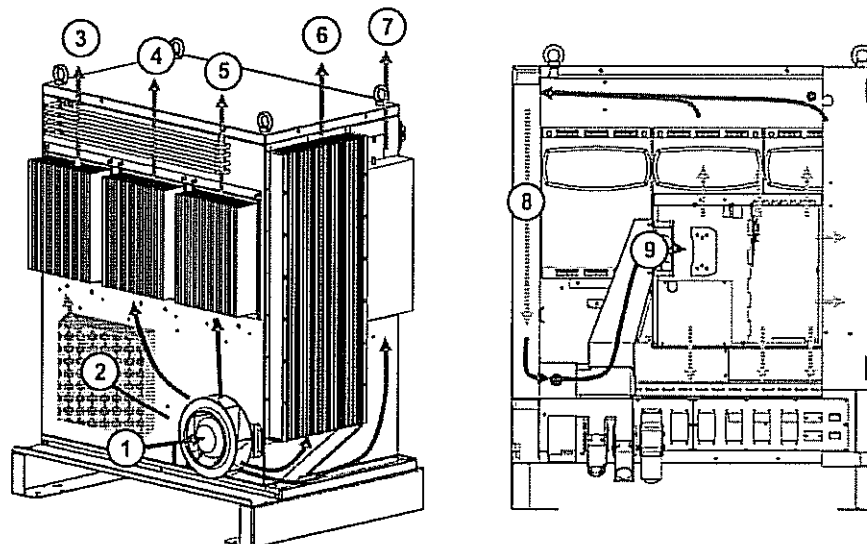


Fig. 3-9: Cooling circuits

- | | |
|---------------------------------------|------------------------------|
| 1 Air inlet, external fan | 6 Air outlet, heat exchanger |
| 2 Heat sink, low-voltage power supply | 7 Air outlet, mains filter |
| 3 Air outlet, KPP | 8 Heat exchanger |
| 4 Air outlet, KSP | 9 KPC intake duct |
| 5 Air outlet, KSP | |

3.18 Mounting plate for customer components

Overview

The mounting plate for customer components can be used for external customer equipment depending on the installed hardware options on the mounting rail TS35.

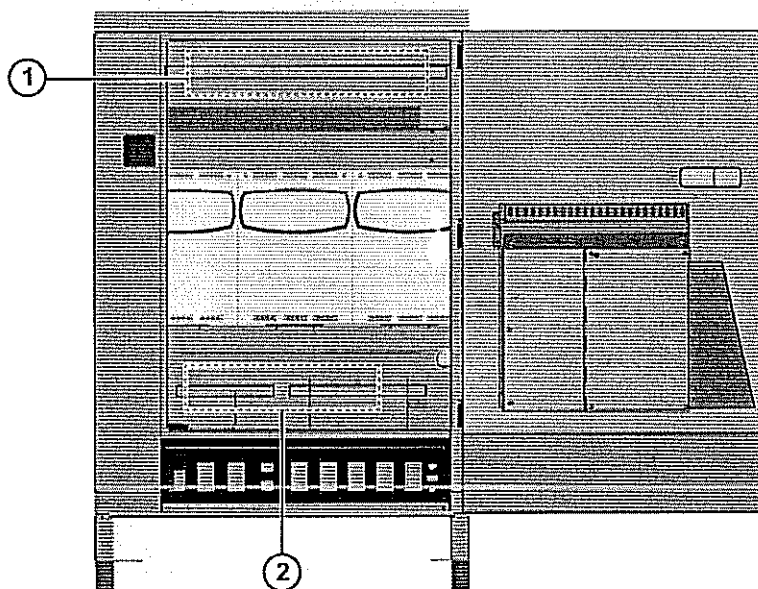


Fig. 3-10

- 1 Upper mounting plate for customer components
- 2 Lower mounting plate for customer components

4 Technical data

Basic data

Cabinet type	KR C4
Color	RAL 7016, door KUKA Orange
Number of axes	max. 8
Weight	160 kg
Protection classification	IP 54
Sound level according to DIN 45635-1	average: 67 dB (A)
Installation with other cabinets (with/without cooling unit)	Side-by-side, clearance 50 mm
Load on cabinet roof with even distribution	1,500 N

Power supply connection

Rated supply voltage	AC 3x400 V The robot controller may only be connected to grounded-neutral power supply systems.
Permissible tolerance of rated voltage	400 V -10% / +10%
Mains frequency	49...61 Hz
System impedance up to the connection point of the robot controller	≤ 300 mΩ
Rated power input	13.5 kVA, see rating plate
Mains-side fusing	min. 3x25 A slow-blowing, max. 3x32 A slow-blowing, see rating plate
RCCB trip current difference	300 mA per robot controller, universal-current sensitive, selective
Equipotential bonding	The common neutral point for the equipotential bonding conductors and all protective ground conductors is the reference bus of the power unit.

Environmental conditions

Ambient temperature during operation without cooling unit	+5 ... 45 °C (278 to 318 K)
Ambient temperature during storage/transportation with batteries	-25 ... +40 °C (248 to 313 K)
Ambient temperature during storage/transportation without batteries	-25 ... +70 °C (248 to 343 K)
Temperature change	max. 1.1 K/min
Humidity class	3k3 acc. to DIN EN 60721-3-3; 1995
Altitude	■ up to 1000 m above mean sea level with no reduction in power ■ 1000 to 4000 m above mean sea level with a reduction in power of 5%/1000 m

NOTICE

To prevent exhaustive discharge and thus destruction of the batteries, the batteries must be recharged at regular intervals according to the storage temperature.

If the storage temperature is +20 °C or lower, the batteries must be recharged every 9 months.

If the storage temperature is between +20 °C and +30 °C, the batteries must be recharged every 6 months.

If the storage temperature is between +30 °C and +40 °C, the batteries must be recharged every 3 months.

Vibration resistance

Type of loading	During transportation	During continuous operation
r.m.s. acceleration (sustained oscillation)	0.37 g	0.1 g
Frequency range (sustained oscillation)	4 - 120 Hz	
Acceleration (shock in X/Y/Z direction)	10 g	2.5 g
Waveform/duration (shock in X/Y/Z direction)	Half-sine/11 ms	

If more severe mechanical stress is expected, the controller must be installed on anti-vibration components.

Control unit

Supply voltage	DC 27.1 V ± 0.1 V
----------------	-------------------

Control PC

Main processor	See shipping version
DIMM memory modules	See shipping version (min. 2x512 MB)
Hard drive	See shipping version

KUKA smartPAD

Supply voltage	DC 20...27.1 V
Dimensions (WxHxD)	approx. 33x26x8 cm ³
Display	Touch-sensitive color display 600x800 pixels
Display size	8.4 "
Interfaces	USB
Weight	1.1 kg

Cable lengths

For cable designations, standard lengths and optional lengths, please refer to the operating instructions or assembly instructions of the manipulator.



When using smartPAD cable extensions, only **two** extensions may be used. An overall cable length of 50 m may not be exceeded.

4.1 Mounting plate for customer components**Upper mounting plate for customer components**

Power dissipation of installed components	max. 50 W
Depth of installed components	approx. 200 mm
Width	650 mm
Height	150 mm

Lower mounting plate for customer components

Power dissipation of installed components	max. 20 W
Depth of installed components	approx. 200 mm
Width	300 mm
Height	150 mm

4.2 External 24 V power supply

PELV external power supply

External voltage	PELV power supply unit acc. to EN 60950 with rated voltage 27 V (18 V ... 30 V), safely isolated
Continuous current	> 8 A
Cable cross-section of power supply cable	$\geq 1 \text{ mm}^2$
Cable length of power supply cable	< 50 m, or < 100 m wire length (outgoing and incoming lines)



The cables of the power supply unit must not be routed together with power-carrying cables.



The minus connection of the external voltage must be grounded by the customer.



Parallel connection of a basic-insulated device is not permitted.

4.3 Safety Interface Board

SIB outputs

 The power contacts must only be fed from a safely isolated PELV power supply unit. (>>> 4.2 "External 24 V power supply" Page 27)	
Operating voltage, power contacts	$\leq 30 \text{ V}$
Current via power contact	min. 10 mA < 750 mA
Cable lengths (connection of actuators)	< 50 m cable lengths < 100 m wire length (outgoing and incoming lines)
Cable cross-section (connection of actuators)	$\geq 1 \text{ mm}^2$
Switching cycles, Standard SIB	Service life: 20 years < 100,000 (corresponds to 13 switching cycles per day)
Switching cycles, Extended SIB	Service life: 20 years < 780,000 (corresponds to 106 switching cycles per day)

The module must be exchanged when the number of switching cycles is exceeded.

SIB inputs

Switching level of the inputs	The state for the inputs is not defined for the voltage range 5 V ... 11 V (transition range). Either the ON state or the OFF state is set. OFF state for the voltage range from -3 V to 5 V (OFF range). ON state for the voltage range from 11 V to 30 V (ON range).
Load current with 24 V supply voltage	> 10 mA
Load current with 18 V supply voltage	> 6.5 mA
Max. load current	< 15 mA
Cable length, terminal - sensor	< 50 m, or < 100 m wire length (outgoing and incoming lines)
Cable cross-section, test output - input connection	> 0.5 mm ²
Capacitive load for the test outputs per channel	< 200 nF
Resistive load for the test outputs per channel	< 33 Ω



Test outputs A and B are sustained short-circuit proof. The specified currents flow via the contact element connected to the input. This must be rated for the maximum current of 15 mA.

4.4 Dimensions of robot controller

The dimensions of the robot controller are indicated in the diagram (>>> Fig. 4-1).

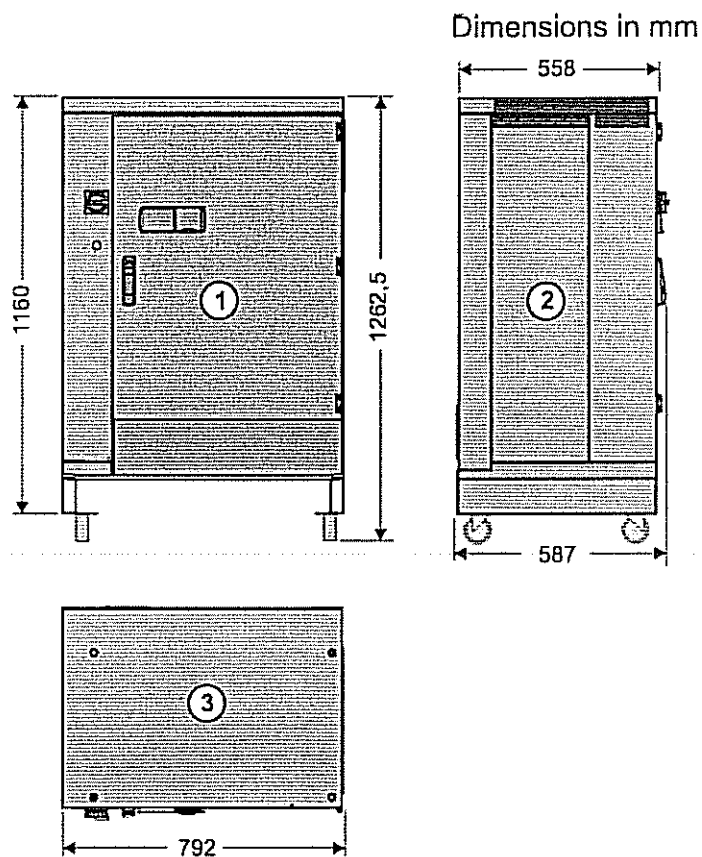


Fig. 4-1: Dimensions

- 1 Front view
- 2 Side view
- 3 Top view

4.5 Minimum clearances, robot controller

The minimum clearances that must be maintained for the robot controller are indicated in the diagram (>>> Fig. 4-2).

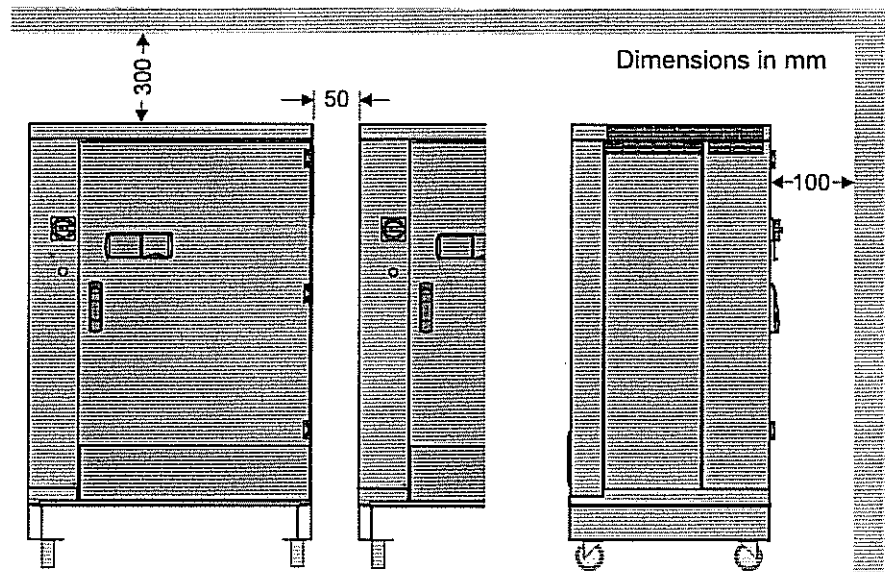


Fig. 4-2: Minimum clearances

NOTICE

If the minimum clearances are not maintained, this can result in damage to the robot controller. The specified minimum clearances must always be observed.



Certain maintenance and repair tasks on the robot controller (>>> 10 "Maintenance" Page 105) (>>> 11 "Repair" Page 109) must be carried out from the side or from the rear. The robot controller must be accessible for this. If the side or rear panels are not accessible, it must be possible to move the robot controller into a position in which the work can be carried out.

4.6 Swing range for cabinet door

The diagram (>>> Fig. 4-3) shows the swing range for the door.

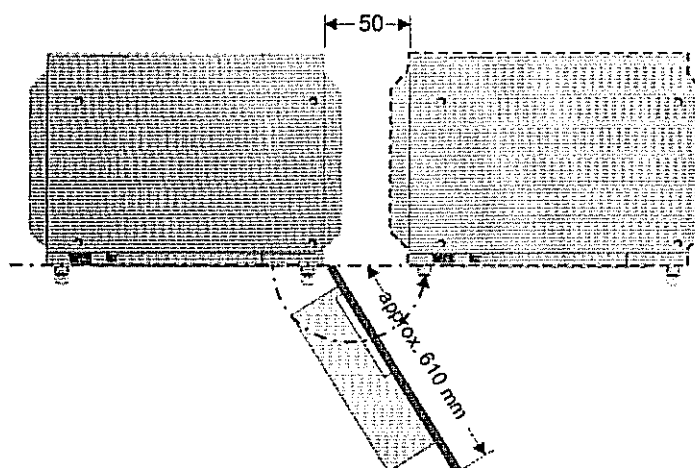


Fig. 4-3: Swing range for cabinet door

Swing range, standalone cabinet:

■ Door with computer frame approx. 180°

Swing range, butt-mounted cabinets:

- Door approx. 155°

4.7 Dimensions of the smartPAD holder (optional)

The diagram (>>> Fig. 4-4) shows the dimensions and drilling locations for mounting on the robot controller or safety fence.

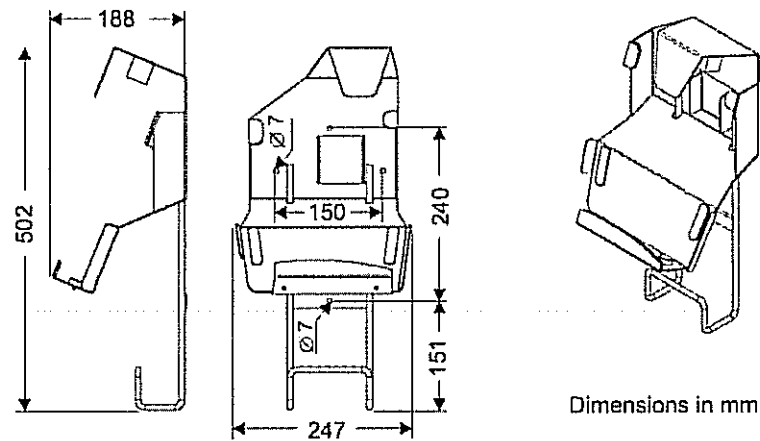


Fig. 4-4: Dimensions and drilling locations for smartPAD holder

4.8 Dimensions of boreholes for floor mounting

The dimensions of the boreholes for floor mounting are indicated in the diagram (>>> Fig. 4-5).

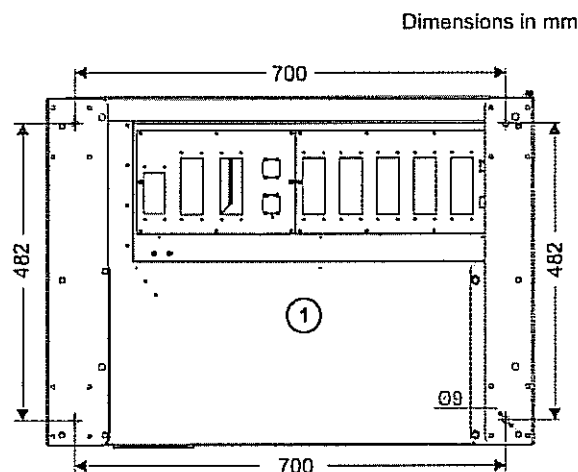


Fig. 4-5: Boreholes for floor mounting

1 View from below

4.9 Dimensions of boreholes for technology cabinet

The diagram (>>> Fig. 4-6) shows the dimensions of the boreholes on the KR C4 for fastening the technology cabinet.

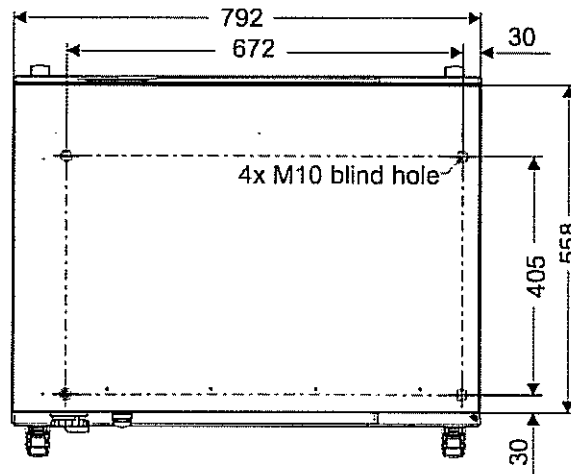


Fig. 4-6: Fastening the technology cabinet

1 View from above

The diagram (>>> Fig. 4-7) shows the dimensions of the boreholes on the adapter rails for fastening the technology cabinet.

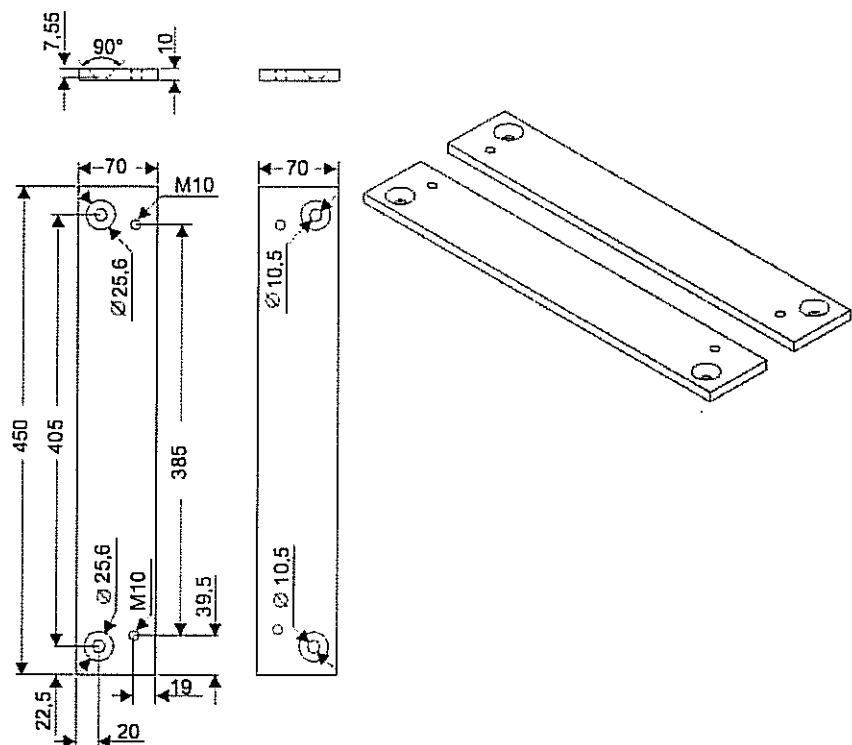


Fig. 4-7: Technology cabinet, fastening on mounting rails

4.10 Plates and labels

Overview

The following plates and labels are attached to the robot controller.

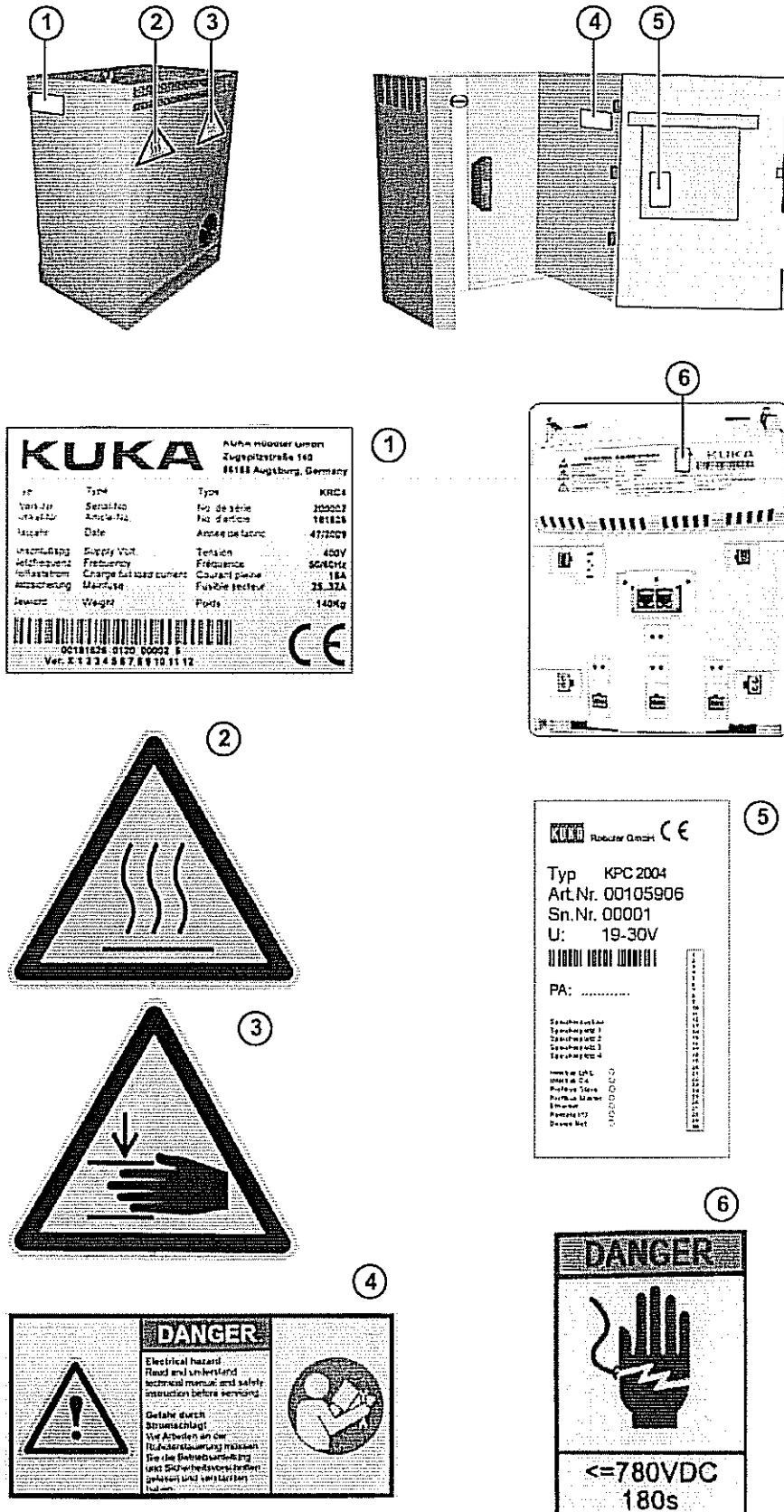


Fig. 4-8: Plates and labels

i The plates may vary slightly from the examples illustrated above depending on the specific cabinet type or as a result of updates.

Designations

Plate no.	Designation
1	Robot controller identification plate
2	Hot surface warning sign
3	Hand injury warning sign
4	Warning: read manual
5	Control PC identification plate
6	Warning: ≤ 780 VDC / wait 180 s

5 Safety

5.1 General

5.1.1 Liability

The device described in this document is either an industrial robot or a component thereof.

Components of the industrial robot:

- ≡ Manipulator
- ≡ Robot controller
- ≡ Teach pendant
- ≡ Connecting cables
- ≡ External axes (optional)
e.g. linear unit, turn-tilt table, positioner
- ≡ Software
- ≡ Options, accessories

The industrial robot is built using state-of-the-art technology and in accordance with the recognized safety rules. Nevertheless, misuse of the industrial robot may constitute a risk to life and limb or cause damage to the industrial robot and to other material property.

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons who are fully aware of the risks involved in its operation. Use of the industrial robot is subject to compliance with this document and with the declaration of incorporation supplied together with the industrial robot. Any functional disorders affecting the safety of the industrial robot must be rectified immediately.

Safety information

Safety information cannot be held against KUKA Roboter GmbH. Even if all safety instructions are followed, this is not a guarantee that the industrial robot will not cause personal injuries or material damage.

No modifications may be carried out to the industrial robot without the authorization of KUKA Roboter GmbH. Additional components (tools, software, etc.), not supplied by KUKA Roboter GmbH, may be integrated into the industrial robot. The user is liable for any damage these components may cause to the industrial robot or to other material property.

In addition to the Safety chapter, this document contains further safety instructions. These must also be observed.

5.1.2 Intended use of the industrial robot

The industrial robot is intended exclusively for the use designated in the "Purpose" chapter of the operating instructions or assembly instructions.



Further information is contained in the "Purpose" chapter of the operating instructions or assembly instructions of the industrial robot.

Using the industrial robot for any other or additional purpose is considered impermissible misuse. The manufacturer cannot be held liable for any damage resulting from such use. The risk lies entirely with the user.

Operating the industrial robot and its options within the limits of its intended use also involves observance of the operating and assembly instructions for

the individual components, with particular reference to the maintenance specifications.

Misuse

Any use or application deviating from the intended use is deemed to be impermissible misuse. This includes e.g.:

- ≡ Transportation of persons and animals
- ≡ Use as a climbing aid
- ≡ Operation outside the permissible operating parameters
- ≡ Use in potentially explosive environments
- ≡ Operation without additional safeguards
- ≡ Outdoor operation

5.1.3 EC declaration of conformity and declaration of incorporation

This industrial robot constitutes partly completed machinery as defined by the EC Machinery Directive. The industrial robot may only be put into operation if the following preconditions are met:

- ≡ The industrial robot is integrated into a complete system.
Or: The industrial robot, together with other machinery, constitutes a complete system.
Or: All safety functions and safeguards required for operation in the complete machine as defined by the EC Machinery Directive have been added to the industrial robot.
- ≡ The complete system complies with the EC Machinery Directive. This has been confirmed by means of an assessment of conformity.

Declaration of conformity

The system integrator must issue a declaration of conformity for the complete system in accordance with the Machinery Directive. The declaration of conformity forms the basis for the CE mark for the system. The industrial robot must be operated in accordance with the applicable national laws, regulations and standards.

The robot controller is CE certified under the EMC Directive and the Low Voltage Directive.

Declaration of incorporation

The industrial robot as partly completed machinery is supplied with a declaration of incorporation in accordance with Annex II B of the EC Machinery Directive 2006/42/EC. The assembly instructions and a list of essential requirements complied with in accordance with Annex I are integral parts of this declaration of incorporation.

The declaration of incorporation declares that the start-up of the partly completed machinery remains impermissible until the partly completed machinery has been incorporated into machinery, or has been assembled with other parts to form machinery, and this machinery complies with the terms of the EC Machinery Directive, and the EC declaration of conformity is present in accordance with Annex II A.

The declaration of incorporation, together with its annexes, remains with the system integrator as an integral part of the technical documentation of the complete machinery.

5.1.4 Terms used

STOP 0, STOP 1 and STOP 2 are the stop definitions according to EN 60204-1:2006.

Term	Description
Axis range	Range of each axis, in degrees or millimeters, within which it may move. The axis range must be defined for each axis.
Stopping distance	Stopping distance = reaction distance + braking distance The stopping distance is part of the danger zone.
Workspace	The manipulator is allowed to move within its workspace. The workspace is derived from the individual axis ranges.
Operator (User)	The user of the industrial robot can be the management, employer or delegated person responsible for use of the industrial robot.
Danger zone	The danger zone consists of the workspace and the stopping distances.
Service life	The service life of a safety-relevant component begins at the time of delivery of the component to the customer. The service life is not affected by whether the component is used in a robot controller or elsewhere or not, as safety-relevant components are also subject to ageing during storage.
KCP	The KCP (KUKA Control Panel) teach pendant has all the operator control and display functions required for operating and programming the industrial robot. The KCP variant for the KR C4 is called KUKA smartPAD. The general term "KCP", however, is generally used in this documentation.
Manipulator	The robot arm and the associated electrical installations
Safety zone	The safety zone is situated outside the danger zone.
Safe operational stop	The safe operational stop is a standstill monitoring function. It does not stop the robot motion, but monitors whether the robot axes are stationary. If these are moved during the safe operational stop, a safety stop STOP 0 is triggered. The safe operational stop can also be triggered externally. When a safe operational stop is triggered, the robot controller sets an output to the field bus. The output is set even if not all the axes were stationary at the time of triggering, thereby causing a safety stop STOP 0 to be triggered.
Safety STOP 0	A stop that is triggered and executed by the safety controller. The safety controller immediately switches off the drives and the power supply to the brakes. Note: This stop is called safety STOP 0 in this document.
Safety STOP 1	A stop that is triggered and monitored by the safety controller. The braking process is performed by the non-safety-oriented part of the robot controller and monitored by the safety controller. As soon as the manipulator is at a standstill, the safety controller switches off the drives and the power supply to the brakes. When a safety STOP 1 is triggered, the robot controller sets an output to the field bus. The safety STOP 1 can also be triggered externally. Note: This stop is called safety STOP 1 in this document.

Term	Description
Safety STOP 2	A stop that is triggered and monitored by the safety controller. The braking process is performed by the non-safety-oriented part of the robot controller and monitored by the safety controller. The drives remain activated and the brakes released. As soon as the manipulator is at a standstill, a safe operational stop is triggered. When a safety STOP 2 is triggered, the robot controller sets an output to the field bus. The safety STOP 2 can also be triggered externally. Note: This stop is called safety STOP 2 in this document.
Stop category 0	The drives are deactivated immediately and the brakes are applied. The manipulator and any external axes (optional) perform path-oriented braking. Note: This stop category is called STOP 0 in this document.
Stop category 1	The manipulator and any external axes (optional) perform path-maintaining braking. The drives are deactivated after 1 s and the brakes are applied. Note: This stop category is called STOP 1 in this document.
Stop category 2	The drives are not deactivated and the brakes are not applied. The manipulator and any external axes (optional) are braked with a path-maintaining braking ramp. Note: This stop category is called STOP 2 in this document.
System integrator (plant integrator)	System integrators are people who safely integrate the industrial robot into a complete system and commission it.
T1	Test mode, Manual Reduced Velocity (≤ 250 mm/s)
T2	Test mode, Manual High Velocity (> 250 mm/s permissible)
External axis	Motion axis which is not part of the manipulator but which is controlled using the robot controller, e.g. KUKA linear unit, turn-tilt table, Posiflex.

5.2 Personnel

The following persons or groups of persons are defined for the industrial robot:

- User
- Personnel



All persons working with the industrial robot must have read and understood the industrial robot documentation, including the safety chapter.

User

The user must observe the labor laws and regulations. This includes e.g.:

- The user must comply with his monitoring obligations.
- The user must carry out instructions at defined intervals.

Personnel

Personnel must be instructed, before any work is commenced, in the type of work involved and what exactly it entails as well as any hazards which may exist. Instruction must be carried out regularly. Instruction is also required after particular incidents or technical modifications.

Personnel includes:

- System integrator
- Operators, subdivided into:
 - Start-up, maintenance and service personnel
 - Operating personnel

Cleaning personnel



Installation, exchange, adjustment, operation, maintenance and repair must be performed only as specified in the operating or assembly instructions for the relevant component of the industrial robot and only by personnel specially trained for this purpose.

System integrator The industrial robot is safely integrated into a complete system by the system integrator.

The system integrator is responsible for the following tasks:

- Installing the industrial robot
- Connecting the industrial robot
- Performing risk assessment
- Implementing the required safety functions and safeguards
- Issuing the declaration of conformity
- Attaching the CE mark
- Creating the operating instructions for the complete system

Operator

The operator must meet the following preconditions:

- The operator must be trained for the work to be carried out.
- Work on the industrial robot must only be carried out by qualified personnel. These are people who, due to their specialist training, knowledge and experience, and their familiarization with the relevant standards, are able to assess the work to be carried out and detect any potential hazards.

Example

The tasks can be distributed as shown in the following table.

Tasks	Operator	Programmer	System integrator
Switch robot controller on/off	x	x	x
Start program	x	x	x
Select program	x	x	x
Select operating mode	x	x	x
Calibration (tool, base)		x	x
Master the manipulator		x	x
Configuration		x	x
Programming		x	x
Start-up			x
Maintenance			x
Repair			x
Decommissioning			x
Transportation			x



Work on the electrical and mechanical equipment of the industrial robot may only be carried out by specially trained personnel.

5.3 Workspace, safety zone and danger zone

Workspaces are to be restricted to the necessary minimum size. A workspace must be safeguarded using appropriate safeguards.

The safeguards (e.g. safety gate) must be situated inside the safety zone. In the case of a stop, the manipulator and external axes (optional) are braked and come to a stop within the danger zone.

The danger zone consists of the workspace and the stopping distances of the manipulator and external axes (optional). It must be safeguarded by means of physical safeguards to prevent danger to persons or the risk of material damage.

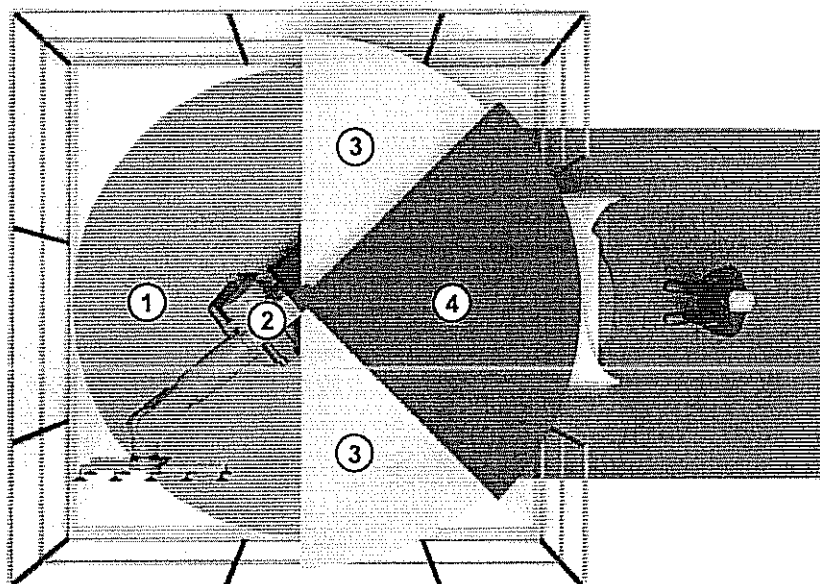


Fig. 5-1: Example of axis range A1

- | | | | |
|---|-------------|---|-------------------|
| 1 | Workspace | 3 | Stopping distance |
| 2 | Manipulator | 4 | Safety zone |

5.4 Triggers for stop reactions

Stop reactions of the industrial robot are triggered in response to operator actions or as a reaction to monitoring functions and error messages. The following tables show the different stop reactions according to the operating mode that has been set.

Trigger	T1, T2	AUT, AUT EXT
Start key released	STOP 2	-
STOP key pressed	STOP 2	
Drives OFF	STOP 1	
"Motion enable" input drops out	STOP 2	
Robot controller switched off (power failure)	STOP 0	
Internal error in non-safety-oriented part of the robot controller	STOP 0 or STOP 1 (dependent on the cause of the error)	
Operating mode changed during operation	Safety stop 2	
Safety gate opened (operator safety)	-	Safety stop 1

Trigger	T1, T2	AUT, AUT EXT
Enabling switch released	Safety stop 2	-
Enabling switch pressed fully down or error	Safety stop 1	-
E-STOP pressed	Safety stop 1	
Error in safety controller or periphery of the safety controller	Safety stop 0	

5.5 Safety functions

5.5.1 Overview of the safety functions

The following safety functions are present in the industrial robot:

- ▣ Mode selection
- ▣ Operator safety (= connection for the guard interlock)
- ▣ EMERGENCY STOP device
- ▣ Enabling device
- ▣ External safe operational stop
- ▣ External safety stop 1
- ▣ External safety stop 2
- ▣ Velocity monitoring in T1

The safety functions of the industrial robot have the following performance: **Category 3** and **Performance Level d** in accordance with EN ISO 13849-1:2008. This corresponds to **SIL 2** and **HFT 1** in accordance with EN 62061.

This performance only applies under the following conditions, however:

- ▣ The EMERGENCY STOP button is pressed at least once every 6 months.

The following components are involved in the safety functions:

- ▣ Safety controller in the control PC
- ▣ KUKA Control Panel (KUKA smartPAD)
- ▣ Cabinet Control Unit (CCU)
- ▣ Resolver Digital Converter (RDC)
- ▣ KUKA Power Pack (KPP)
- ▣ KUKA Servo Pack (KSP)
- ▣ Safety Interface Board (SIB) (if used)

There are also interfaces to components outside the industrial robot and to other robot controllers.



In the absence of operational safety functions and safeguards, the industrial robot can cause personal injury or material damage. If safety functions or safeguards are dismantled or deactivated, the industrial robot may not be operated.



During system planning, the safety functions of the overall system must also be planned and designed. The industrial robot must be integrated into this safety system of the overall system.

5.5.2 Safety controller

The safety controller is a unit inside the control PC. It links safety-relevant signals and safety-relevant monitoring functions.

Safety controller tasks:

- ≡ Switching off the drives; applying the brakes
- ≡ Monitoring the braking ramp
- ≡ Standstill monitoring (after the stop)
- ≡ Velocity monitoring in T1
- ≡ Evaluation of safety-relevant signals
- ≡ Setting of safety-oriented outputs

5.5.3 Mode selection

The industrial robot can be operated in the following modes:

- ≡ Manual Reduced Velocity (T1)
- ≡ Manual High Velocity (T2)
- ≡ Automatic (AUT)
- ≡ Automatic External (AUT EXT)



Do not change the operating mode while a program is running. If the operating mode is changed during program execution, the industrial robot is stopped with a safety stop 2.

Operating mode	Use	Velocities
T1	For test operation, programming and teaching	≡ Program verification: Programmed velocity, maximum 250 mm/s ≡ Jog mode: Jog velocity, maximum 250 mm/s
T2	For test operation	≡ Program verification: Programmed velocity ≡ Jog mode: Not possible
AUT	For industrial robots without higher-level controllers	≡ Program mode: Programmed velocity ≡ Jog mode: Not possible
AUT EXT	For industrial robots with higher-level controllers, e.g. PLC	≡ Program mode: Programmed velocity ≡ Jog mode: Not possible

5.5.4 Operator safety

The operator safety signal is used for interlocking physical safeguards, e.g. safety gates. Automatic operation is not possible without this signal. In the event of a loss of signal during automatic operation (e.g. safety gate is opened), the manipulator stops with a safety stop 1.

Operator safety is not active in the test modes T1 (Manual Reduced Velocity) and T2 (Manual High Velocity).

⚠ WARNING Following a loss of signal, automatic operation must not be resumed merely by closing the safeguard; it must first additionally be acknowledged. It is the responsibility of the system integrator to ensure this. This is to prevent automatic operation from being resumed inadvertently while there are still persons in the danger zone, e.g. due to the safety gate closing accidentally.

- ≡ The acknowledgement must be designed in such a way that an actual check of the danger zone can be carried out first. Acknowledgement functions that do not allow this (e.g. because they are automatically triggered by closure of the safeguard) are not permissible.
- ≡ Failure to observe this may result in death to persons, severe physical injuries or considerable damage to property.

5.5.5 EMERGENCY STOP device

The EMERGENCY STOP device for the industrial robot is the EMERGENCY STOP button on the KCP. The button must be pressed in the event of a hazardous situation or emergency.

Reactions of the industrial robot if the EMERGENCY STOP button is pressed:

- ≡ The manipulator and any external axes (optional) are stopped with a safety stop 1.

Before operation can be resumed, the EMERGENCY STOP button must be turned to release it.

⚠ WARNING Tools and other equipment connected to the manipulator must be integrated into the EMERGENCY STOP circuit on the system side if they could constitute a potential hazard. Failure to observe this precaution may result in death, severe physical injuries or considerable damage to property.

There must always be at least one external EMERGENCY STOP device installed. This ensures that an EMERGENCY STOP device is available even when the KCP is disconnected.

(>>> 5.5.7 "External EMERGENCY STOP device" Page 44)

5.5.6 Logging off the higher-level safety controller

If the robot controller is connected to a higher-level safety controller, switching off the robot controller inevitably terminates this connection.

- ≡ If an SIB interface is used, this triggers an EMERGENCY STOP for the overall system.
- ≡ If the PROFIsafe interface is used, the KUKA safety controller generates a signal that prevents the higher-level controller from triggering an EMERGENCY STOP for the overall system.

⚠ WARNING If the PROFIsafe interface is used: In his risk assessment, the system integrator must take into consideration whether the fact that switching off the robot controller does not trigger an EMERGENCY STOP of the overall system could constitute a hazard and, if so, how this hazard can be countered. Failure to take this into consideration may result in death to persons, severe physical injuries or considerable damage to property.



WARNING If a robot controller is switched off, the E-STOP button on the KCP is no longer functional. The user is responsible for ensuring that the KCP is either covered or removed from the system. This serves to prevent operational and non-operational EMERGENCY STOP facilities from becoming interchanged. Failure to observe this precaution may result in death to persons, severe physical injuries or considerable damage to property.

5.5.7 External EMERGENCY STOP device

There must be EMERGENCY STOP devices available at every operator station that can initiate a robot motion or other potentially hazardous situation. The system integrator is responsible for ensuring this.

There must always be at least one external EMERGENCY STOP device installed. This ensures that an EMERGENCY STOP device is available even when the KCP is disconnected.

External EMERGENCY STOP devices are connected via the customer interface. External EMERGENCY STOP devices are not included in the scope of supply of the industrial robot.

5.5.8 Enabling device

The enabling devices of the industrial robot are the enabling switches on the KCP.

There are 3 enabling switches installed on the KCP. The enabling switches have 3 positions:

- ≡ Not pressed
- ≡ Center position
- ≡ Panic position

In the test modes, the manipulator can only be moved if one of the enabling switches is held in the central position.

- ≡ Releasing the enabling switch triggers a safety stop 2.
- ≡ Pressing the enabling switch down fully (panic position) triggers a safety stop 1.
- ≡ It is possible, for a short time, to hold 2 enabling switches in the center position simultaneously. This makes it possible to adjust grip from one enabling switch to another one. If 2 enabling switches are held simultaneously in the center position for a longer period of time, this triggers a safety stop after several seconds.

If an enabling switch malfunctions (jams), the industrial robot can be stopped using the following methods:

- ≡ Press the enabling switch down fully
- ≡ Actuate the EMERGENCY STOP system
- ≡ Release the Start key



WARNING The enabling switches must not be held down by adhesive tape or other means or manipulated in any other way. Death, serious physical injuries or major damage to property may result.

5.5.9 External enabling device

External enabling devices are required if it is necessary for more than one person to be in the danger zone of the industrial robot. They are connected to the robot controller via interface X11 or PROFIsafe.

External enabling devices are not included in the scope of supply of the industrial robot.

5.5.10 External safe operational stop

The safe operational stop can be triggered via an input on the customer interface. The state is maintained as long as the external signal is FALSE. If the external signal is TRUE, the manipulator can be moved again. No acknowledgement is required.

5.5.11 External safety stop 1 and external safety stop 2

Safety stop 1 and safety stop 2 can be triggered via an input on the customer interface. The state is maintained as long as the external signal is FALSE. If the external signal is TRUE, the manipulator can be moved again. No acknowledgement is required.

5.5.12 Velocity monitoring in T1

The velocity at the TCP is monitored in T1 mode. If, due to an error, the velocity exceeds 250 mm/s, a safety stop 0 is triggered.

5.6 Additional protective equipment

5.6.1 Jog mode

In the operating modes T1 (Manual Reduced Velocity) and T2 (Manual High Velocity), the robot controller can only execute programs in jog mode. This means that it is necessary to hold down an enabling switch and the Start key in order to execute a program.

- Releasing the enabling switch triggers a safety stop 2.
- Pressing the enabling switch down fully (panic position) triggers a safety stop 1.
- Releasing the Start key triggers a STOP 2.

5.6.2 Software limit switches

The axis ranges of all manipulator and positioner axes are limited by means of adjustable software limit switches. These software limit switches only serve as machine protection and must be adjusted in such a way that the manipulator/positioner cannot hit the mechanical end stops.

The software limit switches are set during commissioning of an industrial robot.



Further information is contained in the operating and programming instructions.

5.6.3 Mechanical end stops

The axis ranges of main axes A1 to A3 and wrist axis A5 of the manipulator are limited by means of mechanical end stops with buffers.

Additional mechanical end stops can be installed on the external axes.

NOTICE If the manipulator or an external axis hits an obstruction or a buffer on the mechanical end stop or axis range limitation, this can result in material damage to the industrial robot. KUKA Roboter GmbH must be consulted before the industrial robot is put back into operation. (>>> 14 "KUKA Service" Page 161)
The affected buffer must be replaced with a new one before operation of the industrial robot is resumed. If a manipulator (or external axis) collides with a buffer at more than 250 mm/s, the manipulator (or external axis) must be exchanged or recommissioning must be carried out by KUKA Roboter GmbH.

5.6.4 Mechanical axis range limitation (optional)

Some manipulators can be fitted with mechanical axis range limitation in axes A1 to A3. The adjustable axis range limitation systems restrict the working range to the required minimum. This increases personal safety and protection of the system.

In the case of manipulators that are not designed to be fitted with mechanical axis range limitation, the workspace must be laid out in such a way that there is no danger to persons or material property, even in the absence of mechanical axis range limitation.

If this is not possible, the workspace must be limited by means of photoelectric barriers, photoelectric curtains or obstacles on the system side. There must be no shearing or crushing hazards at the loading and transfer areas.

i This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.6.5 Axis range monitoring (optional)

Some manipulators can be fitted with dual-channel axis range monitoring systems in main axes A1 to A3. The positioner axes may be fitted with additional axis range monitoring systems. The safety zone for an axis can be adjusted and monitored using an axis range monitoring system. This increases personal safety and protection of the system.

i This option is not available for all robot models. Information on specific robot models can be obtained from KUKA Roboter GmbH.

5.6.6 Release device (optional)

Description

The release device can be used to move the manipulator manually after an accident or malfunction. The release device can be used for the main axis drive motors and, depending on the robot variant, also for the wrist axis drive motors. It is only for use in exceptional circumstances and emergencies (e.g. for freeing people).

⚠ CAUTION

The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

Procedure

1. Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
2. Remove the protective cap from the motor.
3. Push the release device onto the corresponding motor and move the axis in the desired direction.

The directions are indicated with arrows on the motors. It is necessary to overcome the resistance of the mechanical motor brake and any other loads acting on the axis.

⚠ WARNING

Moving an axis with the release device can damage the motor brake. This can result in personal injury and material damage. After using the release device, the affected motor must be exchanged.

5.6.7 Labeling on the industrial robot

All plates, labels, symbols and marks constitute safety-relevant parts of the industrial robot. They must not be modified or removed.

Labeling on the industrial robot consists of:

- ▣ Identification plates
- ▣ Warning labels
- ▣ Safety symbols
- ▣ Designation labels
- ▣ Cable markings
- ▣ Rating plates



Further information is contained in the technical data of the operating instructions or assembly instructions of the components of the industrial robot.

5.6.8 External safeguards

The access of persons to the danger zone of the industrial robot must be prevented by means of safeguards. It is the responsibility of the system integrator to ensure this.

Physical safeguards must meet the following requirements:

- ▣ They meet the requirements of EN 953.
- ▣ They prevent access of persons to the danger zone and cannot be easily circumvented.
- ▣ They are sufficiently fastened and can withstand all forces that are likely to occur in the course of operation, whether from inside or outside the enclosure.
- ▣ They do not, themselves, represent a hazard or potential hazard.
- ▣ The prescribed minimum clearance from the danger zone is maintained.

Safety gates (maintenance gates) must meet the following requirements:

- ▣ They are reduced to an absolute minimum.

- The interlocks (e.g. safety gate switches) are linked to the operator safety input of the robot controller via safety gate switching devices or safety PLC.
- Switching devices, switches and the type of switching conform to the requirements of Performance Level d and category 3 according to EN ISO 13849-1.
- Depending on the risk situation: the safety gate is additionally safeguarded by means of a locking mechanism that only allows the gate to be opened if the manipulator is safely at a standstill.
- The button for acknowledging the safety gate is located outside the space limited by the safeguards.



Further information is contained in the corresponding standards and regulations. These also include EN 953.

Other safety equipment

Other safety equipment must be integrated into the system in accordance with the corresponding standards and regulations.

5.7 Overview of operating modes and safety functions

The following table indicates the operating modes in which the safety functions are active.

Safety functions	T1	T2	AUT	AUTEXT
Operator safety	-	-	active	active
EMERGENCY STOP device	active	active	active	active
Enabling device	active	active	-	-
Reduced velocity during program verification	active	-	-	-
Jog mode	active	active	-	-
Software limit switches	active	active	active	active

5.8 Safety measures

5.8.1 General safety measures

The industrial robot may only be used in perfect technical condition in accordance with its intended use and only by safety-conscious persons. Operator errors can result in personal injury and damage to property.

It is important to be prepared for possible movements of the industrial robot even after the robot controller has been switched off and locked. Incorrect installation (e.g. overload) or mechanical defects (e.g. brake defect) can cause the manipulator or external axes to sag. If work is to be carried out on a switched-off industrial robot, the manipulator and external axes must first be moved into a position in which they are unable to move on their own, whether the payload is mounted or not. If this is not possible, the manipulator and external axes must be secured by appropriate means.



In the absence of operational safety functions and safeguards, the industrial robot can cause personal injury or material damage. If safety functions or safeguards are dismantled or deactivated, the industrial robot may not be operated.

⚠ WARNING Standing underneath the robot arm can cause death or serious physical injuries. For this reason, standing underneath the robot arm is prohibited!

⚠ CAUTION The motors reach temperatures during operation which can cause burns to the skin. Contact must be avoided. Appropriate safety precautions must be taken, e.g. protective gloves must be worn.

KCP

The user must ensure that the industrial robot is only operated with the KCP by authorized persons.

If more than one KCP is used in the overall system, it must be ensured that each KCP is unambiguously assigned to the corresponding industrial robot. They must not be interchanged.

⚠ WARNING The operator must ensure that decoupled KCPs are immediately removed from the system and stored out of sight and reach of personnel working on the industrial robot. This serves to prevent operational and non-operational EMERGENCY STOP facilities from becoming interchanged. Failure to observe this precaution may result in death, severe physical injuries or considerable damage to property.

External keyboard, external mouse

An external keyboard and/or external mouse may only be used if the following conditions are met:

- ▣ Start-up or maintenance work is being carried out.
- ▣ The drives are switched off.
- ▣ There are no persons in the danger zone.

The KCP must not be used as long as an external keyboard and/or external mouse are connected.

The external keyboard and/or external mouse must be removed as soon as the start-up or maintenance work is completed or the KCP is connected.

Faults

The following tasks must be carried out in the case of faults in the industrial robot:

- ▣ Switch off the robot controller and secure it (e.g. with a padlock) to prevent unauthorized persons from switching it on again.
- ▣ Indicate the fault by means of a label with a corresponding warning (tag-out).
- ▣ Keep a record of the faults.
- ▣ Eliminate the fault and carry out a function test.

Modifications

After modifications to the industrial robot, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).

After modifications to the industrial robot, existing programs must always be tested first in Manual Reduced Velocity mode (T1). This applies to all components of the industrial robot and includes modifications to the software and configuration settings.

5.8.2 Transportation

Manipulator	The prescribed transport position of the manipulator must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the manipulator.
Robot controller	The robot controller must be transported and installed in an upright position. Avoid vibrations and impacts during transportation in order to prevent damage to the robot controller. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the robot controller.
External axis (optional)	The prescribed transport position of the external axis (e.g. KUKA linear unit, turn-tilt table, etc.) must be observed. Transportation must be carried out in accordance with the operating instructions or assembly instructions of the external axis.

5.8.3 Start-up and recommissioning

Before starting up systems and devices for the first time, a check must be carried out to ensure that the systems and devices are complete and operational, that they can be operated safely and that any damage is detected.

The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.



The passwords for logging onto the KUKA System Software as "Expert" and "Administrator" must be changed before start-up and must only be communicated to authorized personnel.



The robot controller is preconfigured for the specific industrial robot. If cables are interchanged, the manipulator and the external axes (optional) may receive incorrect data and can thus cause personal injury or material damage. If a system consists of more than one manipulator, always connect the connecting cables to the manipulators and their corresponding robot controllers.



If additional components (e.g. cables), which are not part of the scope of supply of KUKA Roboter GmbH, are integrated into the industrial robot, the user is responsible for ensuring that these components do not adversely affect or disable safety functions.



If the internal cabinet temperature of the robot controller differs greatly from the ambient temperature, condensation can form, which may cause damage to the electrical components. Do not put the robot controller into operation until the internal temperature of the cabinet has adjusted to the ambient temperature.

Function test

The following tests must be carried out before start-up and recommissioning:

General test:

It must be ensured that:

- ≡ The industrial robot is correctly installed and fastened in accordance with the specifications in the documentation.
- ≡ There are no foreign bodies or loose parts on the industrial robot.
- ≡ All required safety equipment is correctly installed and operational.
- ≡ The power supply ratings of the industrial robot correspond to the local supply voltage and mains type.

- The ground conductor and the equipotential bonding cable are sufficiently rated and correctly connected.
- The connecting cables are correctly connected and the connectors are locked.

Test of the safety functions:

A function test must be carried out for the following safety functions to ensure that they are functioning correctly:

- Local EMERGENCY STOP device (= EMERGENCY STOP button on the KCP)
- External EMERGENCY STOP device (input and output)
- Enabling device (in the test modes)
- Operator safety
- All other safety-relevant inputs and outputs used
- Other external safety functions

Test of reduced velocity control:

This test is to be carried out as follows:

1. Program a straight path with the maximum possible velocity.
2. Calculate the length of the path.
3. Execute the path in T1 mode with the override set to 100% and time the motion with a stopwatch.

⚠ WARNING It must be ensured that no persons are present within the danger zone during path execution. Death or severe physical injuries may result.

4. Calculate the velocity from the length of the path and the time measured for execution of the motion.

Control of reduced velocity is functioning correctly if the following results are achieved:

- The calculated velocity does not exceed 250 mm/s.
- The manipulator executes the path as programmed (i.e. in a straight line, without deviations).

Machine data

It must be ensured that the rating plate on the robot controller has the same machine data as those entered in the declaration of incorporation. The machine data on the rating plate of the manipulator and the external axes (optional) must be entered during start-up.

⚠ DANGER The industrial robot must not be moved if incorrect machine data are loaded. Death, severe physical injuries or considerable damage to property may otherwise result. The correct machine data must be loaded.

Following modifications to the machine data, the safety configuration must be checked.

i Further information is contained in the Operating and Programming Instructions for System Integrators.

Following modifications to the machine data, control of the reduced velocity must be checked.

5.8.3.1 Start-up mode

Description

The industrial robot can be set to Start-up mode via the smartHMI user interface. In this mode, the manipulator can be moved in T1 or CRR mode in the absence of the safety periphery. (CRR is an operating mode specifically for use with SafeOperation.)

- ≡ If an SIB interface is used:
Start-up mode is always possible if all input signals have the state "logic zero". If this is not the case, the robot controller prevents or terminates Start-up mode.
- ≡ If the PROFIsafe interface is used:
If a connection to a higher-level safety system exists or is established, the robot controller prevents or terminates Start-up mode.

Hazards

Possible hazards and risks involved in using Start-up mode:

- ≡ A person walks into the manipulator's danger zone.
- ≡ An unauthorized person moves the manipulator.
- ≡ In a hazardous situation, a disabled external EMERGENCY STOP device is actuated and the manipulator is not shut down.

Additional measures for avoiding risks in Start-up mode:

- ≡ Cover disabled EMERGENCY STOP devices or attach a warning sign indicating that the EMERGENCY STOP device is out of operation.
- ≡ If there is no safety fence, other measures must be taken to prevent persons from entering the manipulator's danger zone, e.g. use of warning tape.
- ≡ Use of Start-up mode must be minimized – and avoided where possible – by means of organizational measures.

Use

Intended use of Start-up mode:

- ≡ Only service personnel who have received safety instruction may use Start-up mode.
- ≡ Start-up in T1 mode or CRR mode when the external safeguards have not yet been installed or put into operation. The danger zone must be delimited at least by means of warning tape.
- ≡ Fault localization (periphery fault).

⚠ DANGER Use of Start-up mode disables all external safeguards. The service personnel are responsible for ensuring that there is no-one in or near the danger zone of the manipulator as long as the safeguards are disabled. Failure to observe this may result in death to persons, physical injuries or damage to property.

Misuse

Any use or application deviating from the designated use is deemed to be impermissible misuse. This includes, for example, use by any other personnel.

KUKA Roboter GmbH accepts no liability for damage or injury caused thereby. The risk lies entirely with the user.

5.8.4 Manual mode

Manual mode is the mode for setup work. Setup work is all the tasks that have to be carried out on the industrial robot to enable automatic operation. Setup work includes:

- ≡ Jog mode

- Teach
- Programming
- Program verification

The following must be taken into consideration in manual mode:

- If the drives are not required, they must be switched off to prevent the manipulator or the external axes (optional) from being moved unintentionally. New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).
- The manipulator, tooling or external axes (optional) must never touch or project beyond the safety fence.
- Workpieces, tooling and other objects must not become jammed as a result of the industrial robot motion, nor must they lead to short-circuits or be liable to fall off.
- All setup work must be carried out, where possible, from outside the safeguarded area.

If the setup work has to be carried out inside the safeguarded area, the following must be taken into consideration:

In Manual Reduced Velocity mode (T1):

- If it can be avoided, there must be no other persons inside the safeguarded area.
If it is necessary for there to be several persons inside the safeguarded area, the following must be observed:
 - Each person must have an enabling device.
 - All persons must have an unimpeded view of the industrial robot.
 - Eye-contact between all persons must be possible at all times.
- The operator must be so positioned that he can see into the danger area and get out of harm's way.

In Manual High Velocity mode (T2):

- This mode may only be used if the application requires a test at a velocity higher than Manual Reduced Velocity.
- Teaching and programming are not permissible in this operating mode.
- Before commencing the test, the operator must ensure that the enabling devices are operational.
- The operator must be positioned outside the danger zone.
- There must be no other persons inside the safeguarded area. It is the responsibility of the operator to ensure this.

5.8.5 Simulation

Simulation programs do not correspond exactly to reality. Robot programs created in simulation programs must be tested in the system in **Manual Reduced Velocity mode (T1)**. It may be necessary to modify the program.

5.8.6 Automatic mode

Automatic mode is only permissible in compliance with the following safety measures:

- All safety equipment and safeguards are present and operational.
- There are no persons in the system.
- The defined working procedures are adhered to.

If the manipulator or an external axis (optional) comes to a standstill for no apparent reason, the danger zone must not be entered until an EMERGENCY STOP has been triggered.

5.8.7 Maintenance and repair

After maintenance and repair work, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

The purpose of maintenance and repair work is to ensure that the system is kept operational or, in the event of a fault, to return the system to an operational state. Repair work includes troubleshooting in addition to the actual repair itself.

The following safety measures must be carried out when working on the industrial robot:

- Carry out work outside the danger zone. If work inside the danger zone is necessary, the user must define additional safety measures to ensure the safe protection of personnel.
- Switch off the industrial robot and secure it (e.g. with a padlock) to prevent it from being switched on again. If it is necessary to carry out work with the robot controller switched on, the user must define additional safety measures to ensure the safe protection of personnel.
- If it is necessary to carry out work with the robot controller switched on, this may only be done in operating mode T1.
- Label the system with a sign indicating that work is in progress. This sign must remain in place, even during temporary interruptions to the work.
- The EMERGENCY STOP systems must remain active. If safety functions or safeguards are deactivated during maintenance or repair work, they must be reactivated immediately after the work is completed.

WARNING

Before work is commenced on live parts of the robot system, the main switch must be turned off and secured against being switched on again. The system must then be checked to ensure that it is deenergized.

It is not sufficient, before commencing work on live parts, to execute an EMERGENCY STOP or a safety stop, or to switch off the drives, as this does not disconnect the robot system from the mains power supply in the case of the drives of the new generation. Parts remain energized. Death or severe physical injuries may result.

Faulty components must be replaced using new components with the same article numbers or equivalent components approved by KUKA Roboter GmbH for this purpose.

Cleaning and preventive maintenance work is to be carried out in accordance with the operating instructions.

Robot controller

Even when the robot controller is switched off, parts connected to peripheral devices may still carry voltage. The external power sources must therefore be switched off if work is to be carried out on the robot controller.

The ESD regulations must be adhered to when working on components in the robot controller.

Voltages in excess of 50 V (up to 780 V) can be present in various components for several minutes after the robot controller has been switched off! To prevent life-threatening injuries, no work may be carried out on the industrial robot in this time.

Water and dust must be prevented from entering the robot controller.

Counterbalancing system

Some robot variants are equipped with a hydropneumatic, spring or gas cylinder counterbalancing system.

The hydropneumatic and gas cylinder counterbalancing systems are pressure equipment and, as such, are subject to obligatory equipment monitoring. Depending on the robot variant, the counterbalancing systems correspond to category 0, II or III, fluid group 2, of the Pressure Equipment Directive.

The user must comply with the applicable national laws, regulations and standards pertaining to pressure equipment.

Inspection intervals in Germany in accordance with Industrial Safety Order, Sections 14 and 15. Inspection by the user before commissioning at the installation site.

The following safety measures must be carried out when working on the counterbalancing system:

- The manipulator assemblies supported by the counterbalancing systems must be secured.
- Work on the counterbalancing systems must only be carried out by qualified personnel.

Hazardous substances

The following safety measures must be carried out when handling hazardous substances:

- Avoid prolonged and repeated intensive contact with the skin.
- Avoid breathing in oil spray or vapors.
- Clean skin and apply skin cream.



To ensure safe use of our products, we recommend that our customers regularly request up-to-date safety data sheets from the manufacturers of hazardous substances.

5.8.8 Decommissioning, storage and disposal

The industrial robot must be decommissioned, stored and disposed of in accordance with the applicable national laws, regulations and standards.

5.8.9 Safety measures for "single point of control"

Overview

If certain components in the industrial robot are operated, safety measures must be taken to ensure complete implementation of the principle of "single point of control" (SPOC).

Components:

- Submit interpreter
- PLC
- OPC Server
- Remote control tools
- Tools for configuration of bus systems with online functionality
- KUKA.RobotSensorInterface
- External keyboard/mouse



The implementation of additional safety measures may be required. This must be clarified for each specific application; this is the responsibility of the system integrator, programmer or user of the system.

Since only the system integrator knows the safe states of actuators in the periphery of the robot controller, it is his task to set these actuators to a safe state, e.g. in the event of an EMERGENCY STOP.

T1, T2

In the test modes, the components referred to above (with the exception of the external keyboard/mouse) may only access the industrial robot if the following signals have the following states:

Signal	State required for SPOC
\$USER_SAF	TRUE
\$SPOC_MOTION_ENABLE	TRUE

Submit interpreter, PLC

If motions, (e.g. drives or grippers) are controlled with the Submit interpreter or the PLC via the I/O system, and if they are not safeguarded by other means, then this control will take effect even in T1 and T2 modes or while an EMERGENCY STOP is active.

If variables that affect the robot motion (e.g. override) are modified with the Submit interpreter or the PLC, this takes effect even in T1 and T2 modes or while an EMERGENCY STOP is active.

Safety measures:

- In the test modes, the system variable \$OV_PRO must not be written to by the Submit interpreter or the PLC.
- Do not modify safety-relevant signals and variables (e.g. operating mode, EMERGENCY STOP, safety gate contact) via the Submit interpreter or PLC.

If modifications are nonetheless required, all safety-relevant signals and variables must be linked in such a way that they cannot be set to a dangerous state by the Submit interpreter or PLC.

OPC server, remote control tools

These components can be used with write access to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system.

Safety measures:

- KUKA stipulates that these components are to be used exclusively for diagnosis and visualization.
Programs, outputs or other parameters of the robot controller must not be modified using these components.
- If these components are used, outputs that could cause a hazard must be determined in a risk assessment. These outputs must be designed in such a way that they cannot be set without being enabled. This can be done using an external enabling device, for example.

Tools for configuration of bus systems

If these components have an online functionality, they can be used with write access to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system.

- WorkVisual from KUKA
- Tools from other manufacturers

Safety measures:

- In the test modes, programs, outputs or other parameters of the robot controller must not be modified using these components.

External keyboard/mouse

These components can be used to modify programs, outputs or other parameters of the robot controller, without this being noticed by any persons located inside the system.

Safety measures:

- ▣ Only use one operator console at each robot controller.
- ▣ If the KCP is being used for work inside the system, remove any keyboard and mouse from the robot controller beforehand.

5.9 Applied norms and regulations

Name	Definition	Edition
2006/42/EC	Machinery Directive: Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)	2006
2004/108/EC	EMC Directive: Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	2004
97/23/EC	Pressure Equipment Directive: Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment	1997
EN ISO 13850	Safety of machinery: Emergency stop - Principles for design	2008
EN ISO 13849-1	Safety of machinery: Safety-related parts of control systems - Part 1: General principles of design	2008
EN ISO 13849-2	Safety of machinery: Safety-related parts of control systems, part 2: Validation	2008
EN ISO 12100-1	Safety of machinery: Basic concepts, general principles for design - Part 1: Basic terminology, methodology	2003
EN ISO 12100-2	Safety of machinery: Basic concepts, general principles for design - Part 2: Technical principles	2003
EN ISO 10218-1	Industrial robots: Safety	2008
EN 614-1	Safety of machinery: Ergonomic design principles - Part 1: Terms and general principles	2006
EN 61000-6-2	Electromagnetic compatibility (EMC): Part 6-2: Generic standards; Immunity for industrial environments	2005
EN 61000-6-4	Electromagnetic compatibility (EMC): Part 6-4: Generic standards; Emission standard for industrial environments	2007
EN 60204-1	Safety of machinery: Electrical equipment of machines - Part 1: General requirements	2006

6 Planning

Overview

Step	Description	Information
1	Electromagnetic compatibility (EMC)	(>>> 6.1 "Electromagnetic compatibility (EMC)" Page 59)
2	Installation conditions for robot controller	(>>> 6.2 "Installation conditions" Page 59)
3	Connection conditions	(>>> 6.3 "Connection conditions" Page 61)
4	Mounting the KUKA smartPAD holder (optional)	(>>> 4.7 "Dimensions of the smartPAD holder (optional)" Page 31)
5	Power supply connection	(>>> 6.5 "Power supply connection via X1 Harting connector" Page 63)
6	Configure and connect interface X11	(>>> 6.6.2 "Wiring example for safe inputs and outputs" Page 67)
7	Configure the PROFIsafe interface	
8	EtherCAT connection on CIB	(>>> 6.8 "EtherCAT connection on the CIB" Page 77)
9	PE equipotential bonding	(>>> 6.9 "PE equipotential bonding" Page 77)
10	Modification of the system structure, exchange of devices	(>>> 11.4 "Modifying the system configuration, exchanging devices" Page 117)
11	Operator Safety acknowledgement	(>>> 6.11 "Operator safety acknowledgement" Page 79)
12	Performance Level	(>>> 6.12 "Performance level" Page 79)

6.1 Electromagnetic compatibility (EMC)

Description

If connecting cables (e.g. field buses, etc.) are routed to the control PC from outside, only shielded cables with an adequate degree of shielding may be used. The cable shield must be connected with maximum surface area to the PE rail in the cabinet using shield terminals (screw-type, no clamps).



The robot controller corresponds to EMC class A, Group 1, in accordance with EN 55011 and is intended for use in an **industrial setting**. Ascertaining the electromagnetic compatibility in other environments can result in difficulties due to conducted and radiated disturbance that may occur.

6.2 Installation conditions

The dimensions of the robot controller are indicated in the diagram (>>> Fig. 6-1).

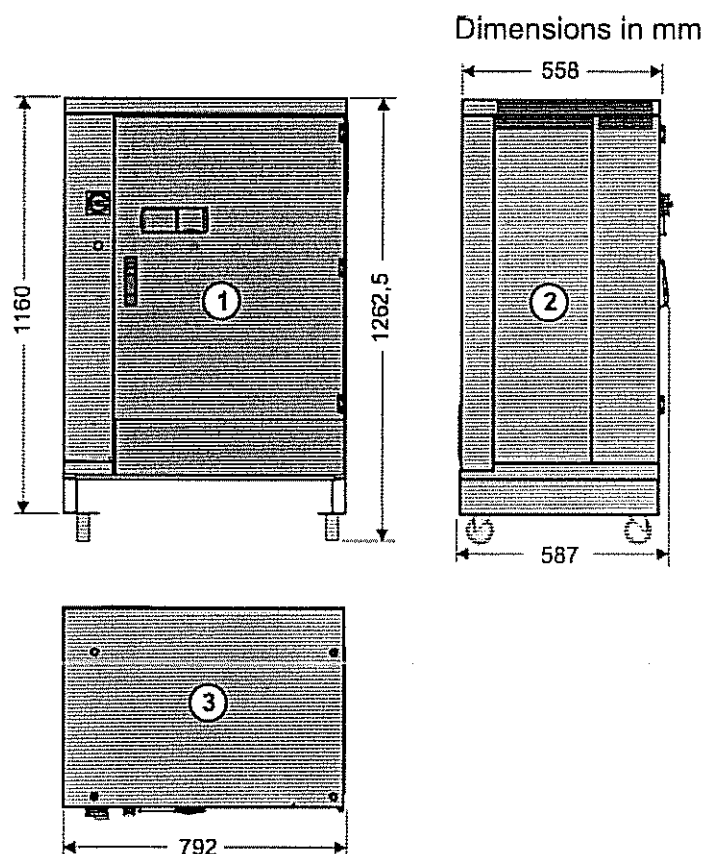


Fig. 6-1: Dimensions

- 1 Front view
- 2 Side view
- 3 Top view

The minimum clearances that must be maintained for the robot controller are indicated in the diagram (>>> Fig. 6-2).

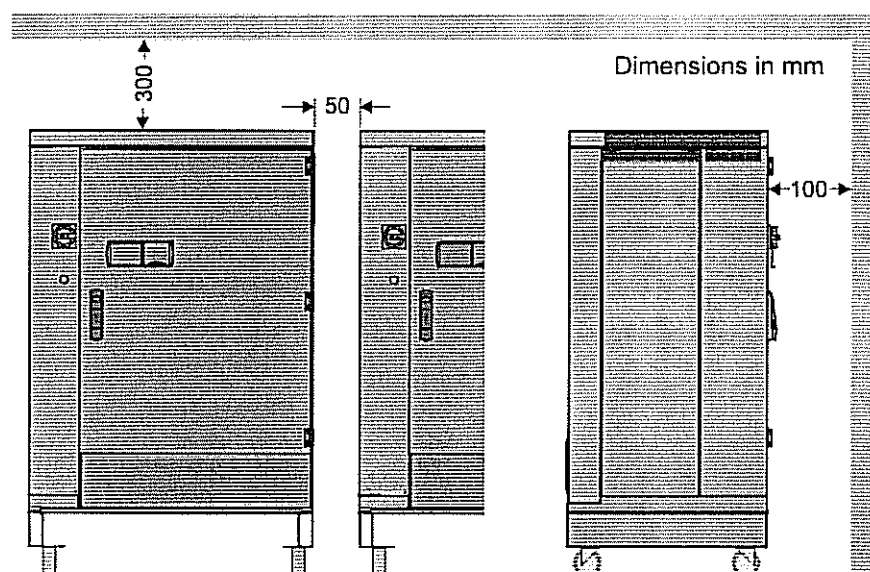


Fig. 6-2: Minimum clearances

NOTICE If the minimum clearances are not maintained, this can result in damage to the robot controller. The specified minimum clearances must always be observed.

i Certain maintenance and repair tasks on the robot controller (>>> 10 "Maintenance" Page 105) (>>> 11 "Repair" Page 109) must be carried out from the side or from the rear. The robot controller must be accessible for this. If the side or rear panels are not accessible, it must be possible to move the robot controller into a position in which the work can be carried out.

The diagram (>>> Fig. 6-3) shows the swing range for the door.

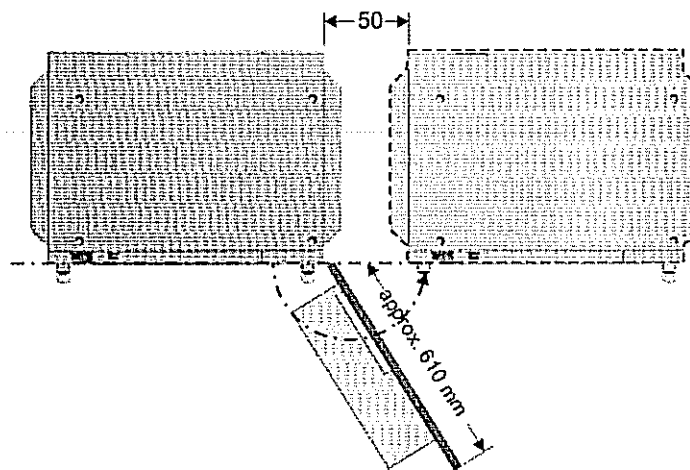


Fig. 6-3: Swing range for cabinet door

Swing range, standalone cabinet:

- Door with computer frame approx. 180°

Swing range, butt-mounted cabinets:

- Door approx. 155°

6.3 Connection conditions

Power supply connection

Rated supply voltage	AC 3x400 V The robot controller may only be connected to grounded-neutral power supply systems.
Permissible tolerance of rated voltage	400 V -10% / +10%
Mains frequency	49...61 Hz
System impedance up to the connection point of the robot controller	≤ 300 mΩ
Rated power input	13.5 kVA, see rating plate
Mains-side fusing	min. 3x25 A slow-blowing, max. 3x32 A slow-blowing, see rating plate

RCCB trip current difference	300 mA per robot controller, universal-current sensitive, selective
Equipotential bonding	The common neutral point for the equipotential bonding conductors and all protective ground conductors is the reference bus of the power unit.

NOTICE If the robot controller is operated with a supply voltage other than that specified on the rating plate, this may cause malfunctions in the robot controller and material damage to the power supply units. The robot controller may only be operated with the supply voltage specified on the rating plate.

CAUTION If the robot controller is connected to a power system **without** a grounded neutral, this may cause malfunctions in the robot controller and material damage to the power supply units. Electrical voltage can cause physical injuries. The robot controller may only be operated with grounded-neutral power supply systems.

Cable lengths

For cable designations, standard lengths and optional lengths, please refer to the operating instructions or assembly instructions of the manipulator.



When using smartPAD cable extensions, only **two** extensions may be used. An overall cable length of 50 m may not be exceeded.

PELV external power supply

External voltage	PELV power supply unit acc. to EN 60950 with rated voltage 27 V (18 V ... 30 V), safely isolated
Continuous current	> 8 A
Cable cross-section of power supply cable	≥ 1 mm ²
Cable length of power supply cable	< 50 m, or < 100 m wire length (outgoing and incoming lines)



The cables of the power supply unit must not be routed together with power-carrying cables.



The minus connection of the external voltage must be grounded by the customer.



Parallel connection of a basic-insulated device is not permitted.

6.4 Fastening the KUKA smartPAD holder (optional)

Overview

The smartPAD holder can be installed on the door of the robot controller or on the safety fence.

The following diagram (>>> Fig. 6-4) shows the options for fastening the smartPAD holder.

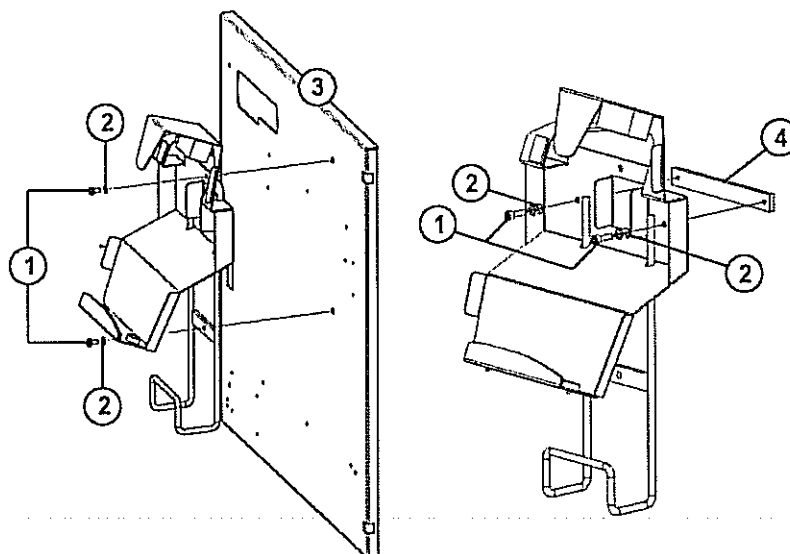


Fig. 6-4: smartPAD holder

- | | |
|--|--------------------------------|
| 1 M6x12 Allen screw | 3 Door of robot controller |
| 2 Spring lock washer A6.1 and plain washer | 4 Iron flat for fence mounting |

6.5 Power supply connection via X1 Harting connector

Description

A Harting connector bypack is supplied with the robot controller. The customer can connect the robot controller to the power supply via connector X1.

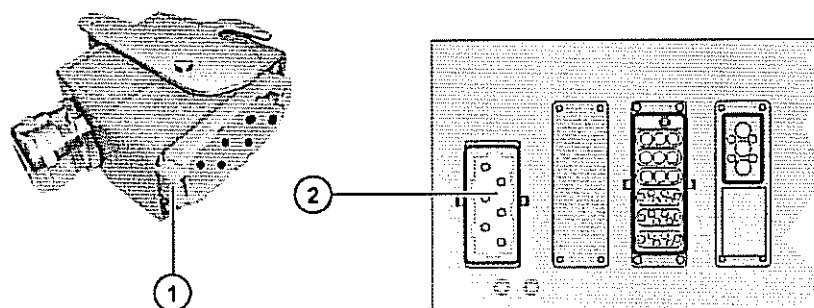


Fig. 6-5: Power supply connection X1

- | |
|---------------------------------------|
| 1 Harting connector bypack (optional) |
| 2 Power supply connection X1 |

6.6 Description of interface X11

Description

EMERGENCY STOP devices must be connected via interface X11 or linked together by means of higher-level controllers (e.g. PLC). (>>> "SIB outputs" Page 27)

Wiring

Take the following points into consideration when wiring interface X11:

- ▣ System concept
- ▣ Safety concept

6.6.1 Interface X11

Connector pin allocation

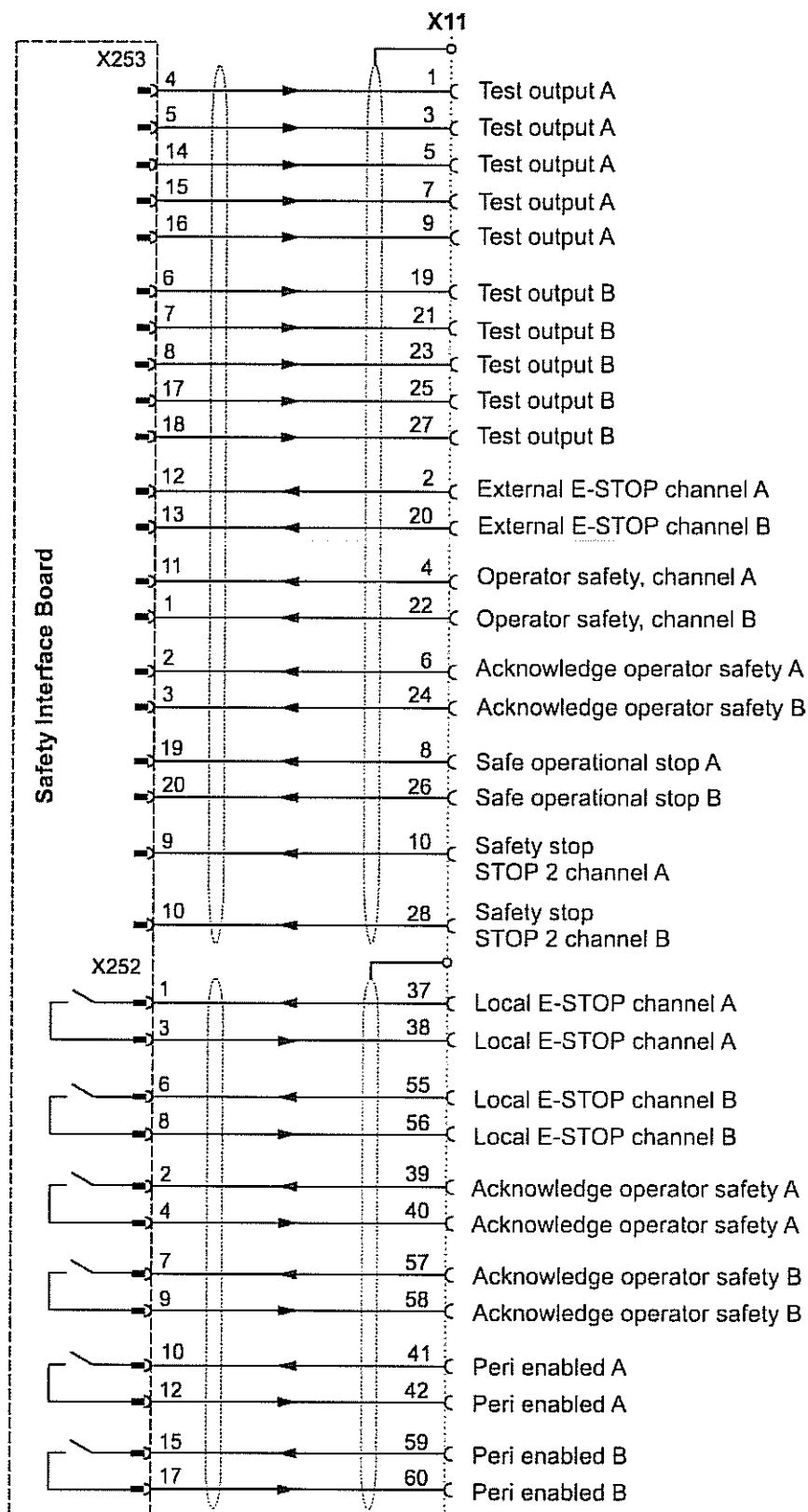


Fig. 6-6: Interface X11, connector pin allocation

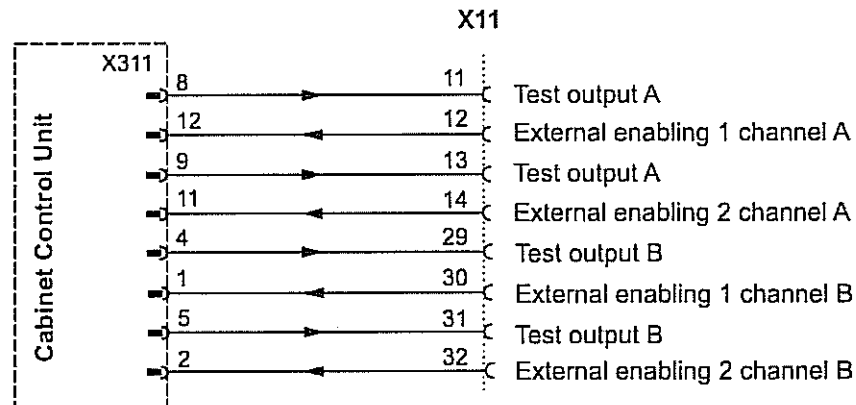


Fig. 6-7: Interface X11, connector pin allocation for external enabling switch

Signal	Pin	Description	Comments
Test output A (test signal)	1	Makes the pulsed voltage available for the individual interface inputs of channel A.	-
	3		
	5		
	7		
	9		
	11		
	13		
Test output B (test signal)	19	Makes the clocked voltage available for the individual interface inputs of channel B.	-
	21		
	23		
	25		
	27		
	29		
	31		
Safe operational stop, channel A	8	Safe operational stop input for all axes	Activation of standstill monitoring
Safe operational stop, channel B	26		Stop 0 is initiated if the activated monitoring is violated.
Safety stop, Stop 2 channel A	10	Safety stop (Stop 2) input for all axes	Triggering of Stop 2 and activation of standstill monitoring at standstill of all axes. Stop 0 is initiated if the activated monitoring is violated.
Safety stop, Stop 2 channel B	28		
Local E-STOP channel A	37 / 38	Output, floating contacts from internal E-STOP, (>>> "SIB outputs" Page 27)	The contacts are closed if the following conditions are met: ▣ E-STOP on smartPAD not actuated ▣ Controller switched on and operational The contacts open if any condition is not met.
Local E-STOP channel B	55 / 56		

Signal	Pin	Description	Comments
External E-STOP channel A	2	Dual-channel E-STOP input, (>>> "SIB inputs" Page 28)	Triggering of the E-STOP function in the robot controller.
External E-STOP channel B	20		
Acknowledge operator safety, channel A	6	For connection of a dual-channel input for acknowledging operator safety with floating contacts, (>>> "SIB inputs" Page 28)	The response of the "Operator safety acknowledgement" input can be configured in the KUKA system software. After closing the safety gate (operator safety), manipulator motion can be enabled in the automatic modes using an acknowledge button outside the safety fence. This function is deactivated on delivery.
Acknowledge operator safety, channel B	24		
External enabling 1 channel A	12	For connection of an external dual-channel enabling switch with floating contacts	If no external enabling switch is connected, pins 11 and 12 and pins 13 and 14 must be jumpered. Only effective in TEST mode.
External enabling 2 channel A	14		
External enabling 1 channel B	30	For connection of an external dual-channel enabling switch with floating contacts	If no external enabling switch is connected, pins 29 and 30 and pins 31 and 32 must be jumpered. Only effective in TEST mode.
External enabling 2 channel B	32		
Operator safety, channel A	4	For 2-channel connection of a safety gate locking mechanism, (>>> "SIB inputs" Page 28)	As long as the signal is active, the drives can be switched on. Only effective in the AUTOMATIC modes.
Operator safety, channel B	22		
Peri enabled channel A	41	Output, floating contact	(>>> "Signal "Peri enabled"" Page 66)
	42	Output, floating contact	
Peri enabled channel B	59	Output, floating contact	
	60	Output, floating contact	
Acknowledge operator safety, channel A	39	Output, floating contact for operator safety acknowledgement, connection 1	Relaying of the acknowledge operator safety input signal to other robot controllers at the same safety fencing.
	40	Output, floating contact for operator safety acknowledgement, connection 2	
Acknowledge operator safety, channel B	57	Output, floating contact for operator safety acknowledgement, connection 1	
	58	Output, floating contact for operator safety acknowledgement, connection 2	

Signal "Peri enabled"

The signal "Peri enabled" is set to 1 (active) if the following conditions are met:

- Drives are activated.
- Safety controller motion enable signal present.
- The message "Operator safety open" must not be active.

“Peri enabled” in conjunction with the signal “Safe operational stop”

- In the case of activation of the signal “Safe operational stop” during the motion:
 - Error -> braking with Stop 0. “Peri enabled” eliminated.
- Activation of the signal “Safe operational stop” with the manipulator stationary:
 - Release the brakes, switch drives to servo-control and monitor for restart. “Peri enabled” remains active.
 - Signal “FF motion enable” remains active.
 - US2 voltage (if present) remains active.
 - Signal “Peri enabled” remains active.

“Peri enabled” in conjunction with the signal “Safety stop 2”

- In the case of activation of the signal “Safety stop 2”:
 - Stop 2 of the manipulator.
 - Signal “Drive enable” remains active.
 - Brakes remain released.
 - Manipulator remains under servo-control.
 - Monitoring for restart active.
 - Signal “Motion enable” is deactivated.
 - US2 voltage (if present) is deactivated.
 - Signal “Peri enabled” is deactivated.



In the cabling for the input signals and test signals in the system, suitable measures must be taken to prevent a cross-connection between the voltages (e.g. separate cabling of input signals and test signals).



In the cabling for the output signals and test signals in the system, suitable measures must be taken to prevent a cross-connection between the output signals of a channel (e.g. separate cabling).

6.6.2 Wiring example for safe inputs and outputs

Safe input

The switch-off capability of the inputs is monitored cyclically.

The inputs of the SIB are of dual-channel design with external testing. The dual-channel operation of the inputs is monitored cyclically.

The following diagram illustrates the connection of a safe input to a floating contact provided by the customer.

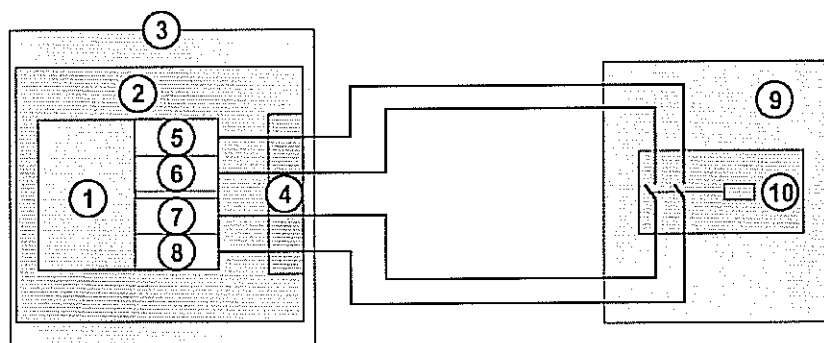


Fig. 6-8: Connection schematic for safe input

- 1 Safe input, SIB
- 2 SIB
- 3 Robot controller
- 4 Interface X11 (XD211) or X13 (XD213)
- 5 Test output channel B
- 6 Test output channel A
- 7 Input X, channel A
- 8 Input X, channel B
- 9 System side
- 10 Floating contact

Test outputs A and B are fed with the supply voltage of the SIB. Test outputs A and B are sustained short-circuit proof. The test outputs must only be used to supply the SIB inputs, and for no other purpose.

The wiring example can be used to achieve compliance with SIL2 (DIN EN 62061), Cat. 3 (DIN EN 13849).

Dynamic testing

- The switch-off capability of the inputs is tested cyclically. For this, the test outputs TA_A and TA_B are switched off alternately.
- The switch-off pulse length is defined for the SIBs as $t_1 = 625 \mu\text{s}$ ($125 \mu\text{s} - 2.375 \text{ ms}$).
- The duration t_2 between two switch-off pulses on one channel is 106 ms.
- The input channel SIN_x_A must be supplied by the test signal TA_A. The input channel SIN_x_B must be supplied by the test signal TA_B. No other power supply is permissible.
- It is only permitted to connect sensors which allow the connection of test signals and which provide floating contacts.
- The signals TA_A and TA_B must not be significantly delayed by the switching element.

Switch-off pulse diagram

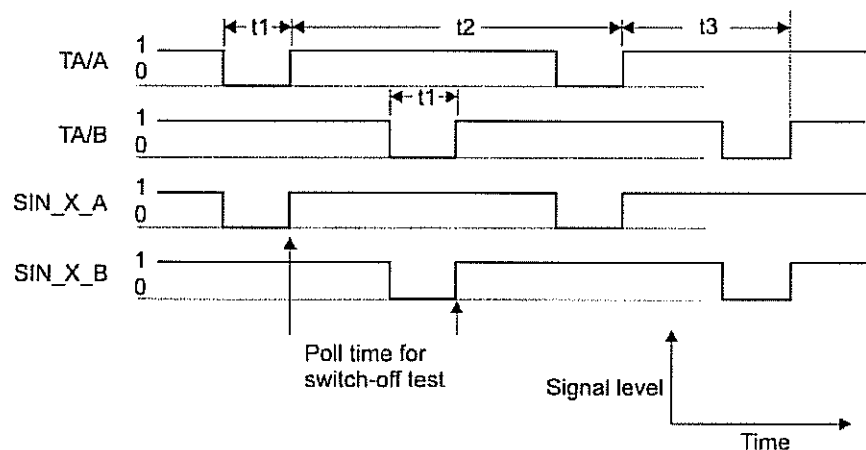


Fig. 6-9: Switch-off pulse diagram, test outputs

- t_1 Switch-off pulse length (fixed or configurable)
- t_2 Switch-off period per channel (106 ms)
- t_3 Offset between switch-off pulses of both channels (53 ms)
- TA/A Test output channel A
- TA/B Test output channel B
- SIN_X_A Input X, channel A
- SIN_X_B Input X, channel B

Safe output

On the SIB, the outputs are provided as dual-channel floating relay outputs.

The following diagram illustrates the connection of a safe output to a safe input provided by the customer with external test facility. The input used by the customer must be monitored externally for cross-connection.

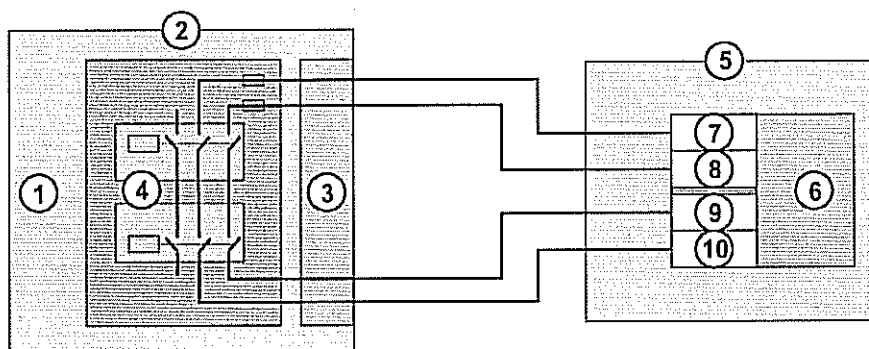


Fig. 6-10: Connection schematic for safe output

- 1 SIB
- 2 Robot controller
- 3 Interface X11 (XD211) or X13 (XD213)
- 4 Output wiring
- 5 System side
- 6 Safe input (Fail Safe PLC, safety switching device)
- 7 Test output channel B
- 8 Test output channel A
- 9 Input X, channel A
- 10 Input X, channel B

The wiring example shown can be used to achieve compliance with SIL2 (DIN EN 62061), Cat. 3 (DIN EN 13849).

6.7 Safety functions via PROFIsafe

Description

The exchange of safety-relevant signals between the controller and the system is carried out via PROFIsafe. The assignment of the input and output states in the PROFIsafe protocol is listed below. In addition, non-safety-oriented information from the safety controller is sent to the non-safe section of the higher-level controller for the purpose of diagnosis and control.

Reserved bits

Reserved safe inputs can be pre-assigned by a PLC with the values 0 or 1. In both cases, the manipulator will move. If a safety function is assigned to a reserved input (e.g. in the case of a software update) and if this input is preset with the value 0, then the manipulator would either not move or would unexpectedly come to a standstill.



KUKA recommends pre-assignment of the reserved inputs with 1. If a reserved input has a new safety function assigned to it, and the input is not used by the customer's PLC, the safety function is not activated. This prevents the safety controller from unexpectedly stopping the manipulator.

Input byte 0

Bit	Signal	Description
0	RES	Reserved 1 The value 1 must be assigned to the input.
1	NHE	Input for external Emergency Stop 0 = external E-STOP is active 1 = external E-STOP is not active
2	BS	Operator safety Input for access to the safety zone. The signal triggers a Stop 1 in the Automatic operating modes. Cancellation of this function must be acknowledged, as the manipulator must not be allowed to resume motion if, for example, a safety gate accidentally closes itself. 0 = operator safety is not active, e.g. safety gate open 1 = operator safety is active
3	QBS	Acknowledgement of operator safety Precondition for acknowledgement of operator safety is the signal "Operator safety assured" set in the BS bit. Note: If the "BS" signal is acknowledged by the system, this must be specified under Hardware options in the safety configuration. Information is contained in the Operating and Programming Instructions for System Integrators. 0 = operator safety has not been acknowledged Edge 0 → 1 = operator safety has been acknowledged
4	SHS1	Safety stop 1 (all axes) Signal for safety stop 1, triggers an intensified ramp stop. The manipulator is stopped as quickly as possible using failsafe technology. All axes are stopped on the path. The drives are switched off after coming to a standstill. FF (motion enable) is set to 0 . Voltage US2 is switched off. AF (drives enable) is set to 0 after 1.5 s. Cancellation of this function does not require acknowledgement. This function is not permissible for the EMERGENCY STOP function. 0 = safety stop is active 1 = safety stop is not active

Bit	Signal	Description
5	SHS2	Safety stop 2 (all axes) Signal for safety stop 2, triggers an intensified ramp stop. The manipulator is stopped as quickly as possible using failsafe technology. All axes are stopped on the path. The drives are not switched off after coming to a standstill. Standstill monitoring is activated. FF (motion enable) is set to 0. Voltage US2 is switched off. Cancellation of this function does not require acknowledgement. This function is not permissible for the EMERGENCY STOP function. 0 = safety stop is active 1 = safety stop is not active
6	RES	-
7	RES	-

Input byte 1

Bit	Signal	Description
0	US2	Supply voltage US2 (signal for switching the second supply voltage, US2, without battery backup) If this output is not used, it should be set to 0. 0 = switch off US2 1 = switch on US2 Note: Whether and how input US2 is used must be specified under Hardware options in the safety configuration. Information is contained in the Operating and Programming Instructions for System Integrators.
1	SBH	Safe operational stop (all axes) Precondition: All axes are stationary The function does not trigger a stop, it only activates the safe standstill monitoring. After activation of the function, the system monitors that all axes maintain their position. Cancellation of this function does not require acknowledgement. This function is not permissible for the EMERGENCY STOP function. 0 = safe operational stop is active. 1 = safe operational stop is not active.
2	RES	Reserved 11 The value 1 must be assigned to the input.
3	RES	Reserved 12 The value 1 must be assigned to the input.
4	RES	Reserved 13 The value 1 must be assigned to the input.
5	RES	Reserved 14 The value 1 must be assigned to the input.

Bit	Signal	Description
6	RES	Reserved 15 The value 1 must be assigned to the input.
7	SPA	Shutdown PROFIsafe Acknowledge The system confirms that it has received the shutdown signal. A second after the "SP" (Shutdown PROFIsafe) signal has been set by the controller, the requested action is executed, without the need for confirmation from the PLC, and the controller shuts down. 0 = confirmation is not active 1 = confirmation is active

Output byte 0

Bit	Signal	Description
0	NHL	Local E-STOP (local E-STOP triggered) 0 = local E-STOP is active 1 = local E-STOP is not active
1	AF	Drives enable (the internal safety controller in the KRC has enabled the drives so that they can be switched on) 0 = drives enable is not active (the robot controller must switch the drives off) 1 = drives enable is active (the robot controller must switch the drives to servo-control)
2	FF	Motion enable (the internal safety controller in the KRC has enabled robot motions) 0 = motion enable is not active (the robot controller must stop the current motion) 1 = motion enable is active (the robot controller may trigger a motion)
3	ZS	One of the enabling switches is in the center position (enabling in test mode) 0 = enabling is not active 1 = enabling is active
4	PE	The signal "Peri enabled" is set to 1 (active) if the following conditions are met: ≡ Drives are activated. ≡ Safety controller motion enable signal present. ≡ The message "Operator safety open" must not be active. (>>> "Signal "Peri enabled"" Page 66)
5	AUT	The manipulator is in AUT or AUT EXT mode. 0 = AUT or AUT EXT mode is not active 1 = AUT or AUT EXT mode is active

Bit	Signal	Description
6	T1	The manipulator is in Manual Reduced Velocity mode. 0 = T1 mode is not active 1 = T1 mode is active
7	T2	The manipulator is in Manual High Velocity mode. 0 = T2 mode is not active 1 = T2 mode is active

Output byte 1

Bit	Signal	Description
0	NHE	External E-STOP has been triggered. 0 = external E-STOP is active 1 = external E-STOP is not active
1	BS	Operator safety 0 = operator safety is not assured 1 = operator safety is assured (input BS = 1 and, if configured, input QBS acknowledged)
2	SHS1	Safety stop 1 (all axes) 0 = Safety stop 1 is not active 1 = Safety stop 1 is active (safe state reached)
3	SHS2	Safety stop 2 (all axes) 0 = Safety stop 2 is not active 1 = Safety stop 2 is active (safe state reached)
4	RES	Reserved 13
5	RES	Reserved 14
6	PSA	PROFIsafe active (display of state of robot controller as PROFIsafe device bus device) Precondition: PROFINET must be installed on the controller. 0 = robot controller on PROFIsafe bus is not active 1 = robot controller on PROFIsafe bus is active
7	SP	Shutdown PROFIsafe (the robot controller announces termination of the PROFIsafe connection) If the PLC transmits the SPA signal as confirmation after receiving the SP signal, PSA is set to 0 and the controller is shut down. One second after the SP signal has been set, the PSA output is reset by the robot controller, without confirmation from the PLC, and the controller is shut down. 0 = announcement of termination of connection is not active 1 = announcement of termination of connection is active

6.7.1 Schematic circuit diagram of PROFI-safe enabling switch

Description

An external enabling switch can be connected to the higher-level safety controller. The signals (ZSE make contact and External panic break contact) must be correctly linked to the PROFI-safe signals in the safety controller. The resulting PROFI-safe signals must then be routed to the PROFI-safe of the KR C4. The response to the external enabling switch is then identical to that for a discretely connected X11.

Signals

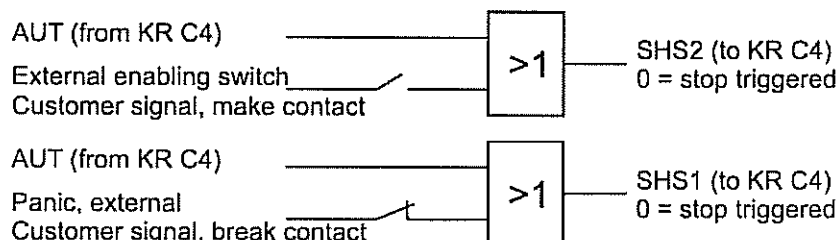


Fig. 6-11: Schematic circuit diagram of external enabling switch

- Enabling switch center position (make contact closed (1) = enabled) OR AUT at SHS2
- Panic (break contact open (0) = panic position) = AND not AUT at SHS1

6.7.2 SafeOperation via PROFI-safe (optional)

Description

The components of the industrial robot move within the limits that have been configured and activated. The actual positions are continuously calculated and monitored against the safety parameters that have been set. The safety controller monitors the industrial robot by means of the safety parameters that have been set. If a component of the industrial robot violates a monitoring limit or a safety parameter, the manipulator and external axes (optional) are stopped. The PROFI-safe interface can be used, for example, to signal a violation of safety monitoring functions.

Reserved bits

Reserved safe inputs can be pre-assigned by a PLC with the values 0 or 1. In both cases, the manipulator will move. If a safety function is assigned to a reserved input (e.g. in the case of a software update) and if this input is preset with the value 0, then the manipulator would either not move or would unexpectedly come to a standstill.



KUKA recommends pre-assignment of the reserved inputs with 1. If a reserved input has a new safety function assigned to it, and the input is not used by the customer's PLC, the safety function is not activated. This prevents the safety controller from unexpectedly stopping the manipulator.

Input byte 2

Bit	Signal	Description
0	JR	Mastering test (input for mastering test reference switch) 0 = reference switch is active (actuated). 1 = reference switch is not active (not actuated).

Bit	Signal	Description
1	VRED	Reduced axis-specific and Cartesian velocity (activation of reduced velocity monitoring) 0 = reduced velocity monitoring is active. 1 = reduced velocity monitoring is not active.
2 ... 7	SBH1 ... 6	Safe operational stop for axis group 1 ... 6 Assignment: Bit 2 = axis group 1 ... bit 7 = axis group 6 Signal for safe operational stop. The function does not trigger a stop, it only activates the safe standstill monitoring. Cancellation of this function does not require acknowledgement. 0 = safe operational stop is active. 1 = safe operational stop is not active.

Input byte 3

Bit	Signal	Description
0 ... 7	RES	Reserved 25 ... 32 The value 1 must be assigned to the inputs.

Input byte 4

Bit	Signal	Description
0 ... 7	UER1 ... 8	Monitoring spaces 1 ... 8 Assignment: Bit 0 = monitoring space 1 ... bit 7 = monitoring space 8 0 = monitoring space is active. 1 = monitoring space is not active.

Input byte 5

Bit	Signal	Description
0 ... 7	UER9 ... 16	Monitoring spaces 9 ... 16 Assignment: Bit 0 = monitoring space 9 ... bit 7 = monitoring space 16 0 = monitoring space is active. 1 = monitoring space is not active.

Input byte 6

Bit	Signal	Description
0 ... 7	WZ1 ... 8	Tool selection 1 ... 8 Assignment: Bit 0 = tool 1 ... bit 7 = tool 8 0 = tool is not active. 1 = tool 1 is active. Exactly one tool must be selected at all times.

Input byte 7

Bit	Signal	Description
0 ... 7	WZ9 ... 16	Tool selection 9 ... 16 Assignment: Bit 0 = tool 9 ... bit 7 = tool 16 0 = tool is not active. 1 = tool 1 is active. Exactly one tool must be selected at all times.

Output byte 2

Bit	Signal	Description
0	SO	SafeOperation active SafeOperation activation status 0 = SafeOperation is not active. 1 = SafeOperation is active.
1	RR	Manipulator referenced Mastering test display 0 = mastering test required. 1 = mastering test performed successfully.
2	JF	Mastering error Space monitoring is deactivated because at least one axis is not mastered. 0 = mastering error. Space monitoring has been deactivated. 1 = no error.
3	VRED	Reduced axis-specific and Cartesian velocity (activation status of reduced velocity monitoring) 0 = reduced velocity monitoring is not active. 1 = reduced velocity monitoring is active.
4 ... 5	SBH1 ... 2	Activation status of safe operational stop for axis group 1 ... 2 Assignment: Bit 4 = axis group 1 ... bit 5 = axis group 2 0 = safe operational stop is not active. 1 = safe operational stop is active.
6 ... 7	RES	Reserved 23 ... 24

Output byte 3

Bit	Signal	Description
0 ... 7	RES	Reserved 25 ... 32

Output byte 4

Bit	Signal	Description
0 ... 7	MR1 ... 8	Alarm space 1 ... 8 Assignment: Bit 0 = alarm space 1 (associated monitoring space 1) ... bit 7 = alarm space 8 (associated monitoring space 8) 0 = space is violated. 1 = space is not violated. Note: The signal is only set to 1 in the event of a workspace violation if the corresponding monitoring space is active, i.e. it must have been configured as "always active" or switched to active by means of the corresponding PRO-FIsafe input (input byte 4).

Output byte 5

Bit	Signal	Description
0 ... 7	MR9 ... 16	Alarm space 9 ... 16 Assignment: Bit 0 = alarm space 9 (associated monitoring space 9) ... bit 7 = alarm space 16 (associated monitoring space 16) 0 = space is violated. 1 = space is not violated. Note: The signal is only set to 1 in the event of a workspace violation if the corresponding monitoring space is active, i.e. it must have been configured as "always active" or switched to active by means of the corresponding PRO-FIsafe input (input byte 5).

Output byte 6

Bit	Signal	Description
0 ... 7	RES	Reserved 48 ... 55

Output byte 7

Bit	Signal	Description
0 ... 7	RES	Reserved 56 ... 63

6.8 EtherCAT connection on the CIB

Description

Connector X44 on the CIB is the interface for connection of EtherCAT slaves inside the robot controller (on the mounting plate for customer components). The EtherCAT line remains in the robot controller. The EtherCAT line can be routed out of the robot controller via the optional connector X65. Information about connector X65 can be found in the assembly and operating instructions of the optional KR C4 interfaces.



The devices in the EtherCAT line must be configured with WorkVisual.

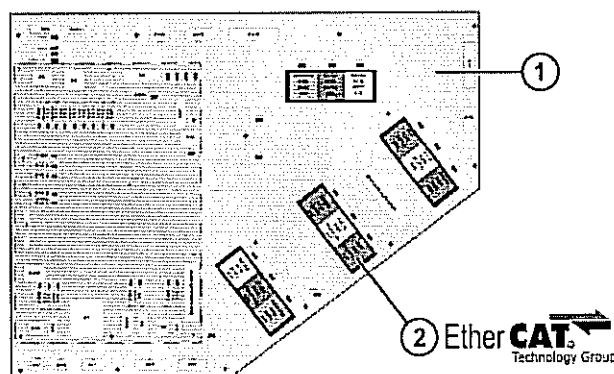


Fig. 6-12: EtherCAT connection X44

- 1 CIB
- 2 EtherCAT connection X44

6.9 PE equipotential bonding

Description

The following cables must be connected before start-up:

- A 16 mm² cable as equipotential bonding between the manipulator and the robot controller.
- An additional PE conductor between the central PE rail of the supply cabinet and the PE bolt of the robot controller. A cross section of 16 mm² is recommended.

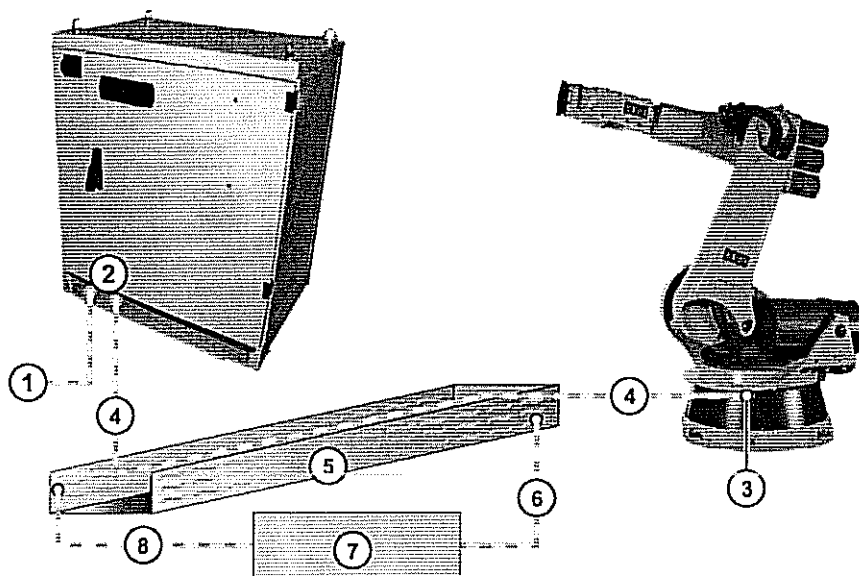


Fig. 6-13: Equipotential bonding from robot controller to manipulator via cable duct

- 1 PE to central PE rail of the supply cabinet
- 2 Connection panel on robot controller
- 3 Equipotential bonding connection on the manipulator
- 4 Equipotential bonding from the robot controller to the manipulator
- 5 Cable duct
- 6 Equipotential bonding from the start of the cable duct to the main equipotential bonding
- 7 Main equipotential bonding
- 8 Equipotential bonding from the end of the cable duct to the main equipotential bonding

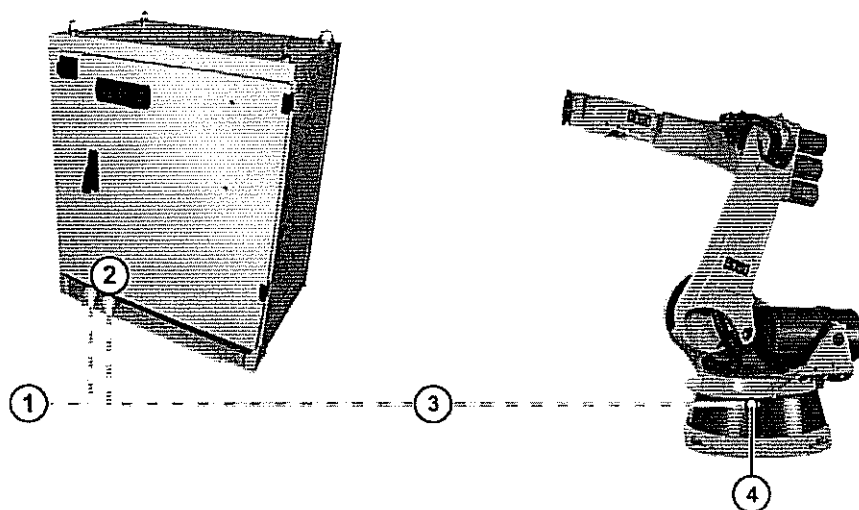


Fig. 6-14: Equipotential bonding, robot controller - manipulator

- 1 PE to central PE rail of the supply cabinet
- 2 Connection panel on robot controller
- 3 Equipotential bonding from the robot controller to the manipulator
- 4 Equipotential bonding connection on the manipulator

6.10 Modifying the system configuration, exchanging devices

Description	The system configuration of the industrial robot must be configured using WorkVisual in the following cases: ▣ Installation of KSS/VSS 8.2 This is the case if a KSS/VSS 8.2 package is installed without KSS/VSS 8.2 already being present (because it has been uninstalled or deleted or has never been installed). ▣ The hard drive has been exchanged. ▣ A device has been replaced by a device of a different type. ▣ More than one device has been replaced by a device of a different type. ▣ One or more devices have been removed. ▣ One or more devices have been added. ▣ Two or more devices have been interchanged.
--------------------	---

Exchanging devices	If a device is exchanged, at least one KCB, KSB or KEB device is replaced by a device of the same type. Any number of KCB, KSB and KEB devices can be exchanged until all devices in the KCB, KSB and KEB have been replaced simultaneously by devices of the same type. Simultaneous exchange of two identical components of the KCB is not possible. Only one of the identical components may be exchanged at any one time.
---------------------------	--



The interchanging of 2 identical devices can only occur in the case of the KSP3x40 if the current system configuration contains 2 KSP3x40.

6.11 Operator safety acknowledgement

A dual-channel acknowledge button must be installed outside the physical safeguard. The closing of the safety gate must be confirmed by pressing the acknowledge button before the industrial robot can be started again in Automatic mode.

6.12 Performance level

The safety functions of the robot controller conform to category 3 and Performance Level d according to EN ISO 13849-1.

6.12.1 PFH values of the safety functions

The safety values are based on a service life of 20 years.

The PFH value classification of the controller is only valid if the E-STOP button is tested at least once every 6 months.

When evaluating system safety functions, it must be remembered that the PFH values for a combination of multiple controllers may have to be taken into consideration more than once. This is the case for RoboTeam systems or higher-level hazard areas. The PFH value determined for the safety function at system level must not exceed the limit for PL d.

The PFH values relate to the specific safety functions of the different controller variants.

Safety function groups:

- Standard safety functions
 - Operating mode selection
 - Operator safety
 - EMERGENCY STOP device
 - Enabling device
 - External safe operational stop
 - External safety stop 1
 - External safety stop 2
 - Velocity monitoring in T1
- Safety functions of KUKA.SafeOperation (option)
 - Monitoring of axis spaces
 - Monitoring of Cartesian spaces
 - Monitoring of axis velocity
 - Monitoring of Cartesian velocity
 - Monitoring of axis acceleration
 - Safe operational stop
 - Tool monitoring

Overview of controller variant PFH values:

Robot controller variant	PFH value
KR C4	$< 1 \times 10^{-7}$
VKR C4 PROFIsafe and retrofit interfaces VKR C2	$< 1 \times 10^{-7}$
KR C4 with KUKA.SafeOperation	$< 1 \times 10^{-7}$
VKR C4 PROFIsafe with KUKA.SafeOperation	$< 1 \times 10^{-7}$
VKR C4 retrofit interface VKR C1, except external EMERGENCY STOP and operator safety functions	$< 1 \times 10^{-7}$
VKR C4 retrofit interface VKR C1, external EMERGENCY STOP and operator safety functions	5×10^{-7}

 For controller variants that are not listed here, please contact KUKA Roboter GmbH.

7 Transportation

7.1 Transportation using lifting tackle

Preconditions

- The robot controller must be switched off.
- No cables may be connected to the robot controller.
- The door of the robot controller must be closed.
- The robot controller must be upright.
- The anti-toppling bracket must be fastened to the robot controller.

Necessary equipment

Lifting tackle with or without lifting frame.

Procedure

1. Attach the lifting tackle with or without a lifting frame to all 4 transport eye-bolts on the robot controller.

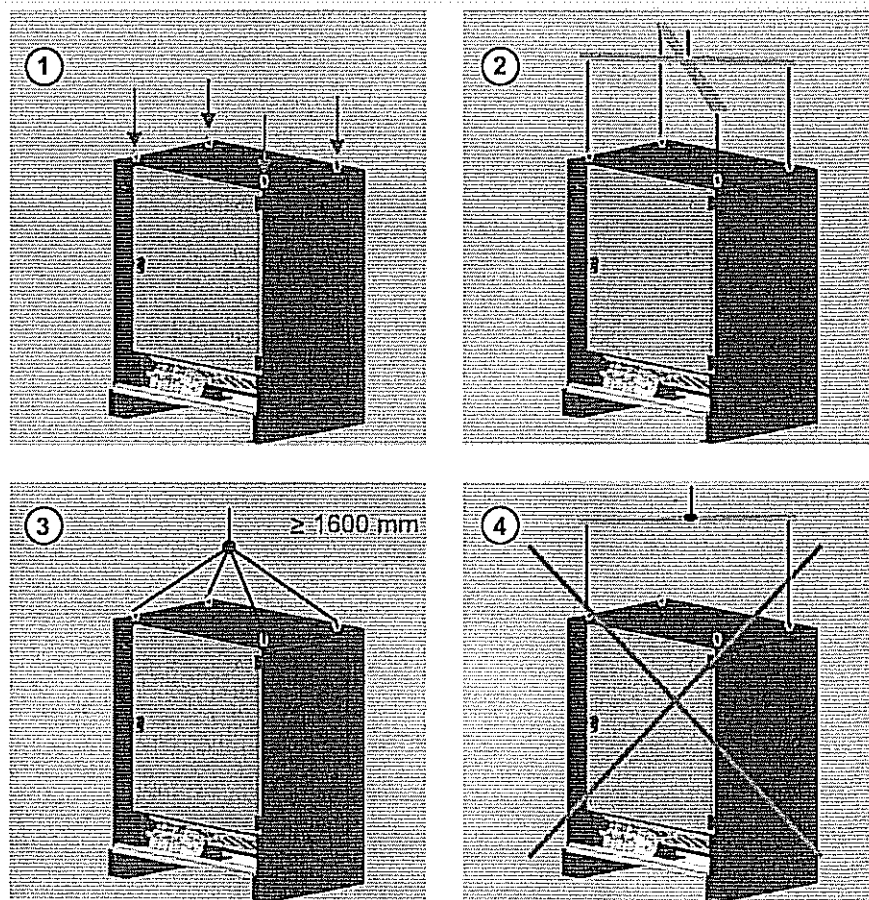


Fig. 7-1: Transportation using lifting tackle

- 1 Transport eyebolts on the robot controller
 - 2 Correctly attached lifting tackle
 - 3 Correctly attached lifting tackle
 - 4 Incorrectly attached lifting tackle
2. Attach the lifting tackle to the crane.



WARNING

If the suspended robot controller is transported too quickly, it may swing and cause injury or damage. Transport the robot controller slowly.

3. Slowly lift and transport the robot controller.
4. Slowly lower the robot controller at its destination.
5. Unhook lifting tackle on the robot controller.

7.2 Transportation by fork lift truck

- Preconditions**
- ≡ The robot controller must be switched off.
 - ≡ No cables may be connected to the robot controller.
 - ≡ The door of the robot controller must be closed.
 - ≡ The robot controller must be upright.
 - ≡ The anti-toppling bracket must be fastened to the robot controller.

Procedure

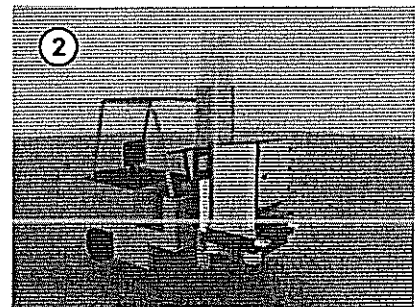
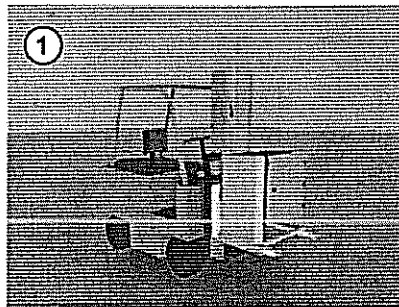


Fig. 7-2: Transportation by fork lift truck

- 1 Robot controller with fork slots
- 2 Robot controller with transformer installation kit

7.3 Transportation by pallet truck

- Preconditions**
- ≡ The robot controller must be switched off.
 - ≡ No cables may be connected to the robot controller.
 - ≡ The door of the robot controller must be closed.
 - ≡ The robot controller must be upright.
 - ≡ The anti-toppling bracket must be fastened to the robot controller.

Procedure

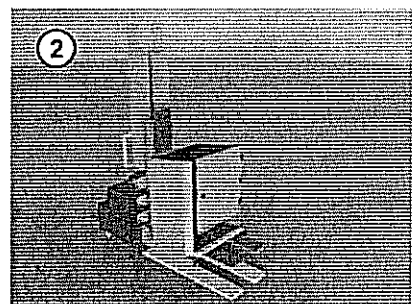
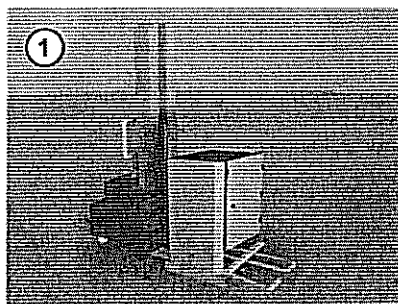


Fig. 7-3: Transportation by pallet truck

- 1 Robot controller with anti-toppling bracket
- 2 Robot controller in raised position

7.4 Transportation with the set of rollers (optional)

Description

The robot controller rollers may only be used to roll the cabinet into and out of a row of cabinets – not to transport the cabinet over longer distances. The floor must be level and free from obstacles, as there is a permanent risk of toppling.

NOTICE If the robot controller is towed by a vehicle (fork lift truck, electrical vehicle), this can result in damage to the rollers and to the robot controller. The robot controller must not be hitched to a vehicle and transported using its rollers.

8 Start-up and recommissioning

8.1 Start-up overview



This is an overview of the most important steps during start-up. The precise sequence depends on the application, the manipulator type, the technology packages used and other customer-specific circumstances. For this reason, the overview does not claim to be comprehensive.



This overview refers to the start-up of the industrial robot. The start-up of the overall system is not within the scope of this documentation.

Manipulator

Step	Description	Information
1	Carry out a visual inspection of the manipulator.	Detailed information is contained in the operating or assembly instructions for the manipulator, in the chapter "Start-up and recommissioning".
2	Install the manipulator mounting base (mounting base, machine frame mounting or booster frame).	
3	Install the manipulator.	

Electrical system

Step	Description	Information
4	Carry out a visual inspection of the robot controller.	-
5	Make sure that no condensation has formed in the robot controller.	-
6	Install the robot controller.	(>>> 8.2 "Installing the robot controller" Page 86)
7	Connect the connecting cables.	(>>> 8.3 "Connecting the standard connecting cables" Page 87)
8	Plug in the KUKA smartPAD.	(>>> 8.6 "Plugging in the KUKA smartPAD" Page 97)
9	Connect the equipotential bonding between the manipulator and the robot controller.	(>>> 8.7 "Connecting the PE equipotential bonding" Page 98)
10	Connect the robot controller to the power supply.	(>>> 8.8 "Connecting the robot controller to the power supply" Page 98)
11	Reverse the battery discharge protection measures.	(>>> 8.9 "Reversing the battery discharge protection measures" Page 99)
12	Configure and connect interface X11.	(>>> 8.10 "Configuring and connecting connector X11" Page 99)
13	Drive configuration modified	(>>> 8.11 "System configuration of the industrial robot modified" Page 100)
14	Start-up mode	(>>> 8.12 "Start-up mode" Page 100)
15	Switch on the robot controller.	(>>> 8.13 "Switching on the robot controller" Page 101)

Step	Description	Information
16	Check the safety equipment.	Detailed information is contained in the operating and assembly instructions for the robot controller, in the chapter "Safety".
17	Configure the inputs/outputs between the robot controller and the periphery.	Detailed information can be found in the field bus documentation.

Software

Step	Description	Information
18	Check the machine data.	Detailed information is contained in the operating and programming instructions
19	Master the manipulator without a load.	
20	Mount the tool and master the manipulator with a load.	
21	Check the software limit switches and adapt them if required.	
22	Calibrate the tool. In the case of a fixed tool: calibrate external TCP.	
23	Enter the load data.	
24	Calibrate the base (optional). In the case of a fixed tool: calibrate workpiece (optional).	Detailed information is contained in the Operating and Programming Instructions for System Integrators.
25	If the manipulator is to be controlled from a host computer or PLC: configure Automatic External interface.	



Long text names of inputs/outputs, flags, etc., can be saved in a text file and imported after a reinstallation. In this way, the long texts do not need to be re-entered manually for each manipulator. Furthermore, the long text names can be updated in application programs.

Accessories

Precondition: the manipulator is ready to move, i.e. the software start-up has been carried out up to and including the item "Master the manipulator without load".

Description	Information
Optional: install and adjust external energy supply system, taking the programming into consideration.	Detailed information can be found in the energy supply system documentation.
Positionally accurate manipulator option: check data.	

8.2 Installing the robot controller

Procedure

1. Install the robot controller. The minimum clearances to walls, other cabinets, etc. must be observed.
2. Check the robot controller for any damage caused during transportation.
3. Check that fuses, contactors and boards are fitted securely.
4. Secure any modules that have come loose.
5. Check that all screwed and clamped connections are securely fastened.

6. The operator must cover the warning label **Read manual** with the label in the relevant local language. (>>> 4.10 "Plates and labels" Page 32)

8.3 Connecting the standard connecting cables

Overview

- A connecting cable set is supplied with the industrial robot. In the standard version this consists of:
 - Motor cables to the manipulator
 - Data cables to the manipulator
- The following cables may be provided for additional applications:
 - Motor cables for external axes
 - Peripheral cables

⚠ DANGER The robot controller is preconfigured for the specific industrial robot. If cables are interchanged, the manipulator and the external axes (optional) may receive incorrect data and can thus cause personal injury or material damage. If a system consists of more than one manipulator, always connect the connecting cables to the manipulators and their corresponding robot controllers.

Procedure

1. Route the motor cables to the manipulator junction box separately from the data cables. Connect standard connector X20 (or X20.1/X20.4 for heavy-duty robot).
2. Route the motor cables of external axes 7 and 8 (optional) to the manipulator junction box separately from the data cables. Insert connectors X7.1 and X7.2.
3. Route the data cables to the manipulator junction box separately from the motor cable. Plug in connector X21.
4. Connect the peripheral cables.

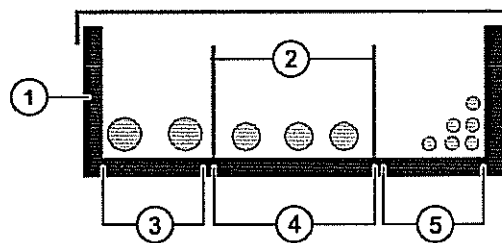


Fig. 8-1: Example: Installing the cables in the cable duct

- | | |
|-------------------|----------------|
| 1 Cable duct | 4 Motor cables |
| 2 Separating webs | 5 Data cables |
| 3 Welding cables | |

8.3.1 Standard motor cables, X20

Connector pin allocation

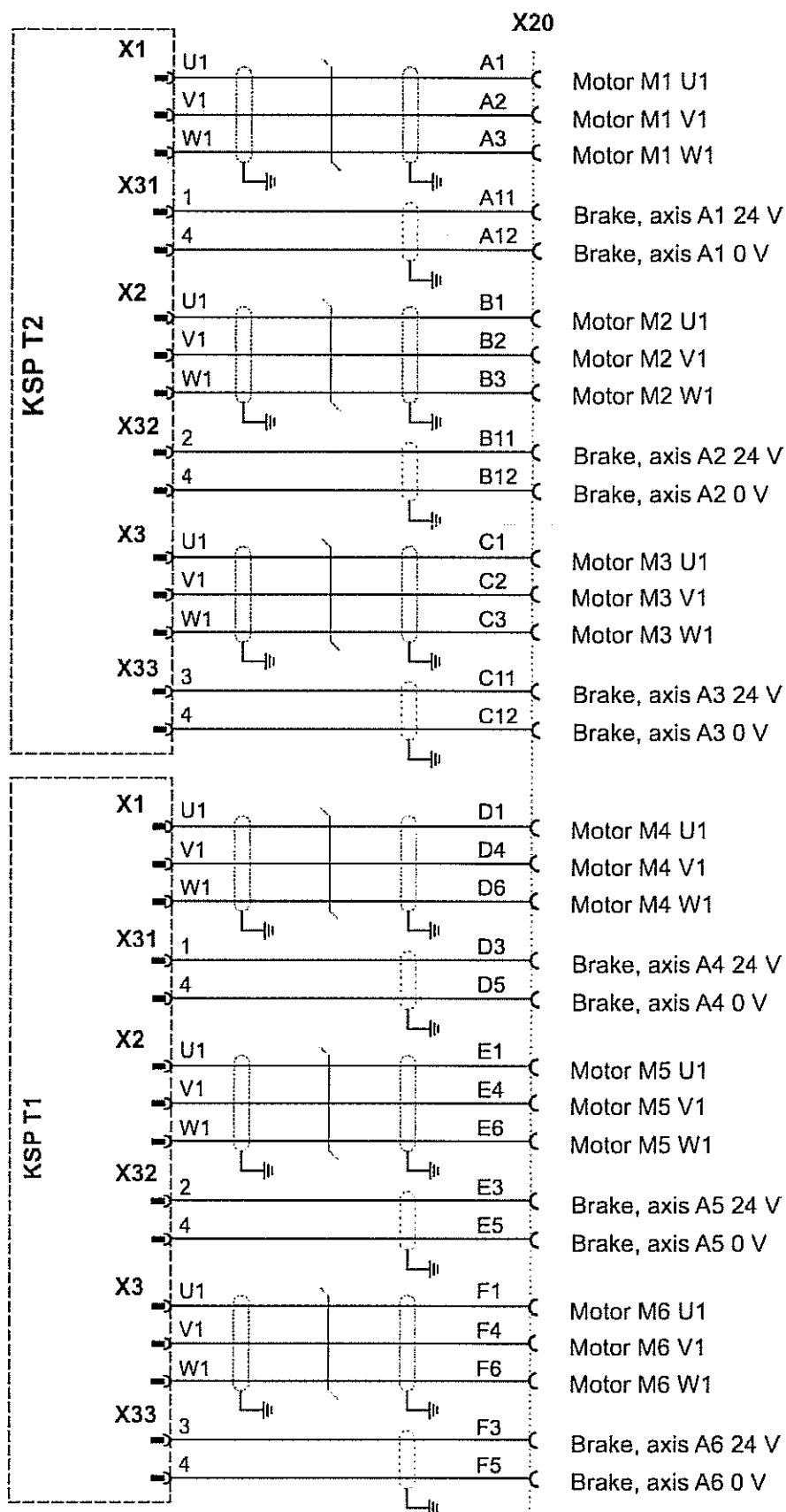


Fig. 8-2: Connector pin allocation for X20

8.3.2 Motor cables for heavy-duty robot, X20.1 and X20.4

Connector pin allocation

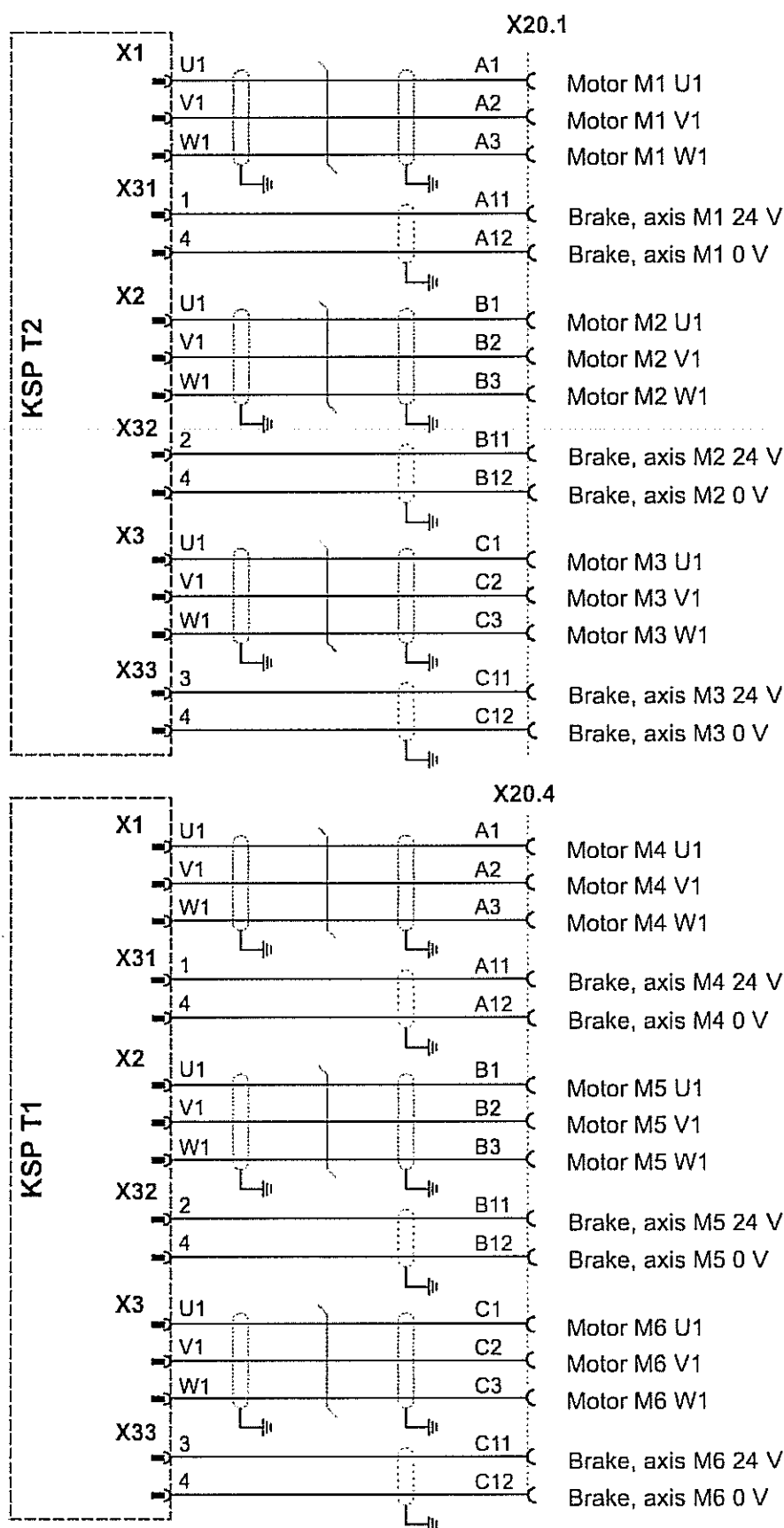


Fig. 8-3: Connector pin allocation for X20.1 and X20.4

8.3.3 Motor cable for external axis, X7.1 (optional)

NOTICE

The motor cable must not exceed a total length of 50 m.

Connector pin allocation

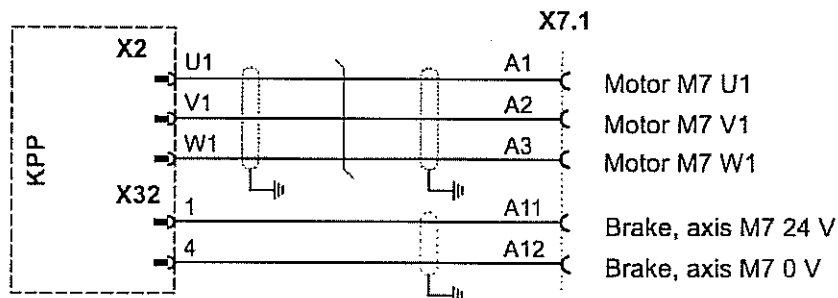


Fig. 8-4: Connector pin allocation X7.1

8.3.4 Motor cable for external axis, X7.2 (optional)

NOTICE

The motor cable must not exceed a total length of 50 m.

Connector pin allocation

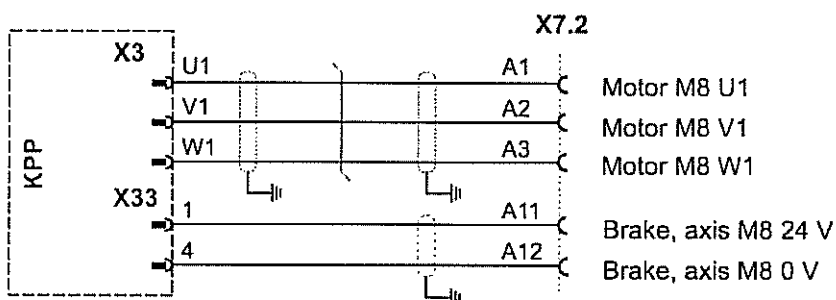


Fig. 8-5: Connector pin allocation X7.2

8.3.5 Data cables, X21

Connector pin allocation

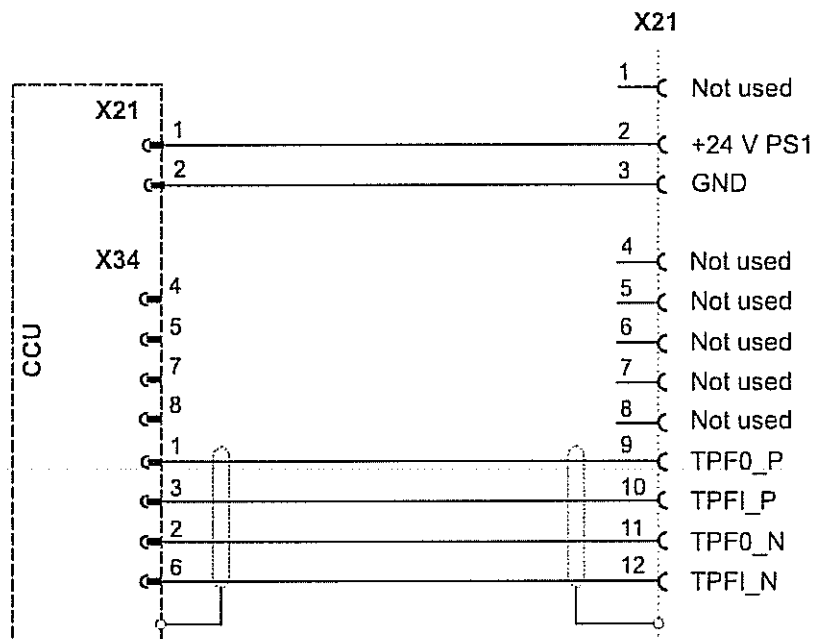


Fig. 8-6: Connector pin allocation for X21

8.4 Connecting the palletizing robot connecting cables (optional)

Overview

- ≡ A connecting cable set is supplied with the industrial palletizing robot. In the standard version this consists of:
 - ≡ Motor cables to the manipulator
 - ≡ Data cables to the manipulator
- ≡ The following cables may be provided for additional applications:
 - ≡ Motor cables for external axes
 - ≡ Peripheral cables



The robot controller is preconfigured for the specific industrial robot. If cables are interchanged, the manipulator and the external axes (optional) may receive incorrect data and can thus cause personal injury or material damage. If a system consists of more than one manipulator, always connect the connecting cables to the manipulators and their corresponding robot controllers.

Procedure

1. Depending on the specific option, route the following motor cables to the manipulator junction box separately from the data cables and connect them:
 - ≡ Connector X20, 4-axis or 5-axis palletizing robot
 - ≡ Connector X20.1/X20.4, heavy-duty robot, 5-axis palletizing robot
 - ≡ Connector X8, heavy-duty robot, 4-axis palletizing robot
2. Route the motor cables of external axes 7 and 8 to the manipulator junction box separately from the data cables. Insert connectors X7.1 and X7.2.
3. Route the data cables to the manipulator junction box separately from the motor cable. Plug in connector X21.
4. Connect the peripheral cables.

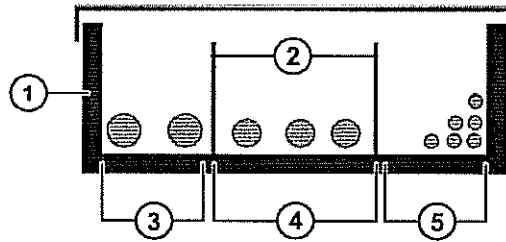


Fig. 8-7: Example: Installing the cables in the cable duct

- | | |
|-------------------|----------------|
| 1 Cable duct | 4 Motor cables |
| 2 Separating webs | 5 Data cables |
| 3 Welding cables | |

8.4.1 5-axis heavy-duty palletizing robot, motor cables X20.1 And X20.4

Connector pin allocation

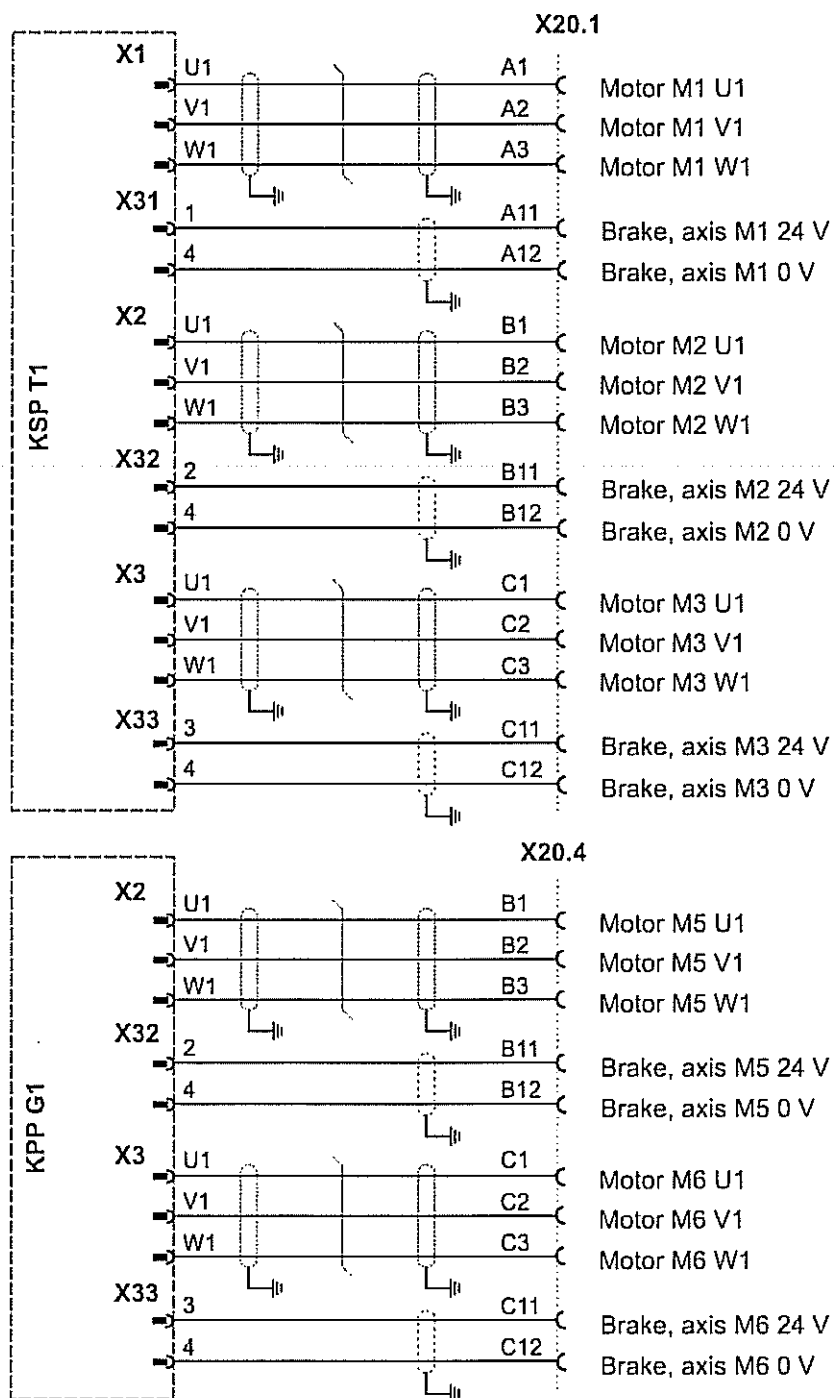


Fig. 8-8: 5-axis palletizing robot, connector pin allocation X20.1 and X20.4

8.4.2 4-axis heavy-duty palletizing robot, motor cables X8

Connector pin allocation

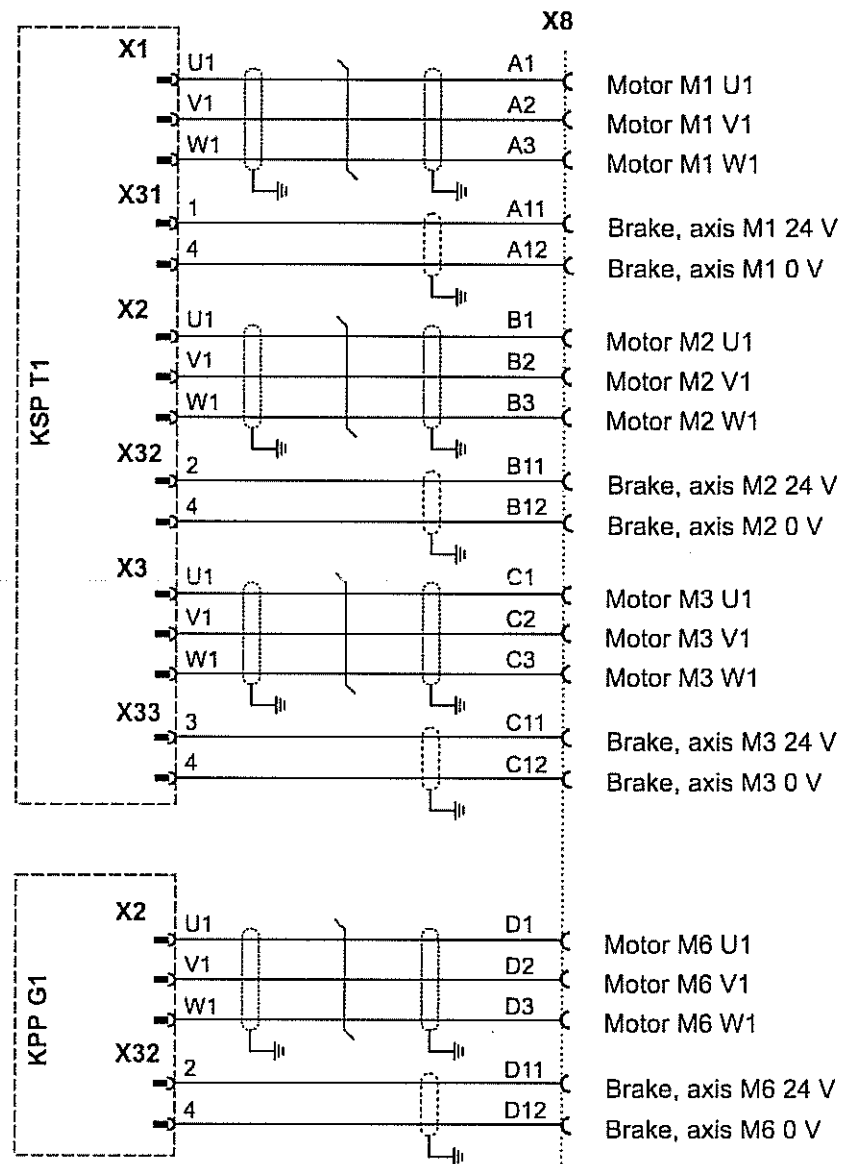


Fig. 8-9: 4-axis heavy-duty palletizing robot, connector pin allocation X8

8.4.3 5-axis palletizing robot, motor cables X20

Connector pin allocation

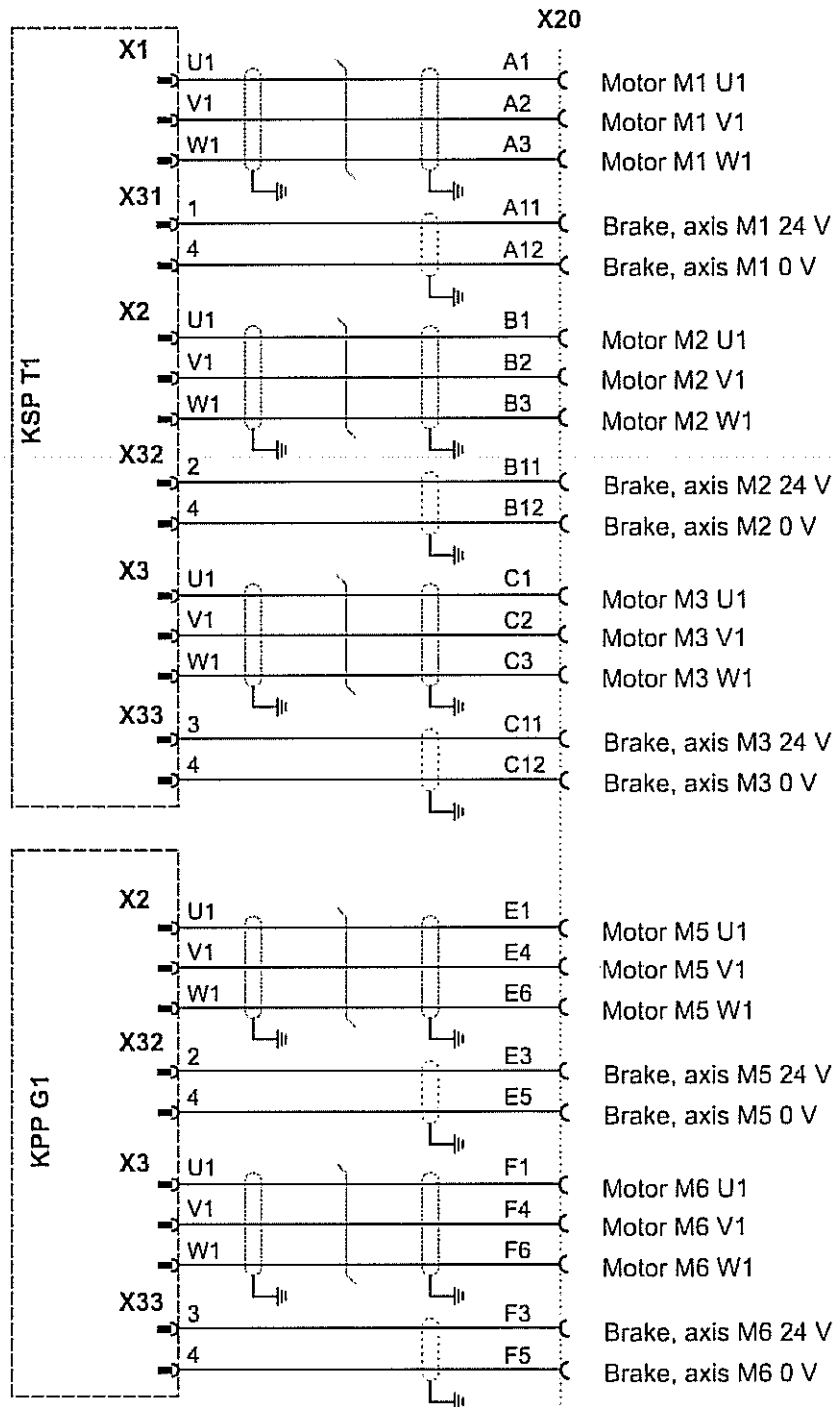


Fig. 8-10: 5-axis palletizing robot, connector pin allocation X20

8.4.4 4-axis palletizing robot, motor cables X20

Connector pin allocation

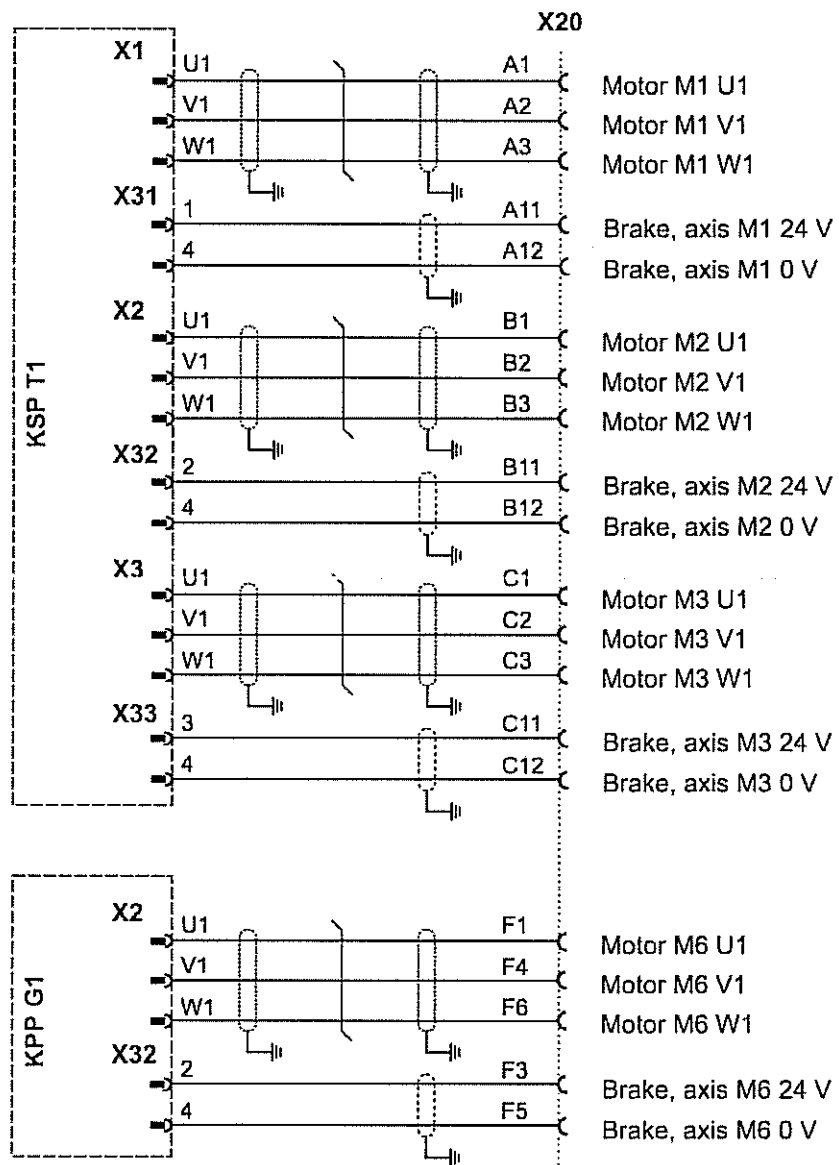


Fig. 8-11: 4-axis palletizing robot, connector pin allocation X20

8.4.5 Palletizing robot motor cable for external axis, X7.1 and X7.2

NOTICE

The motor cable must not exceed a total length of 50 m.

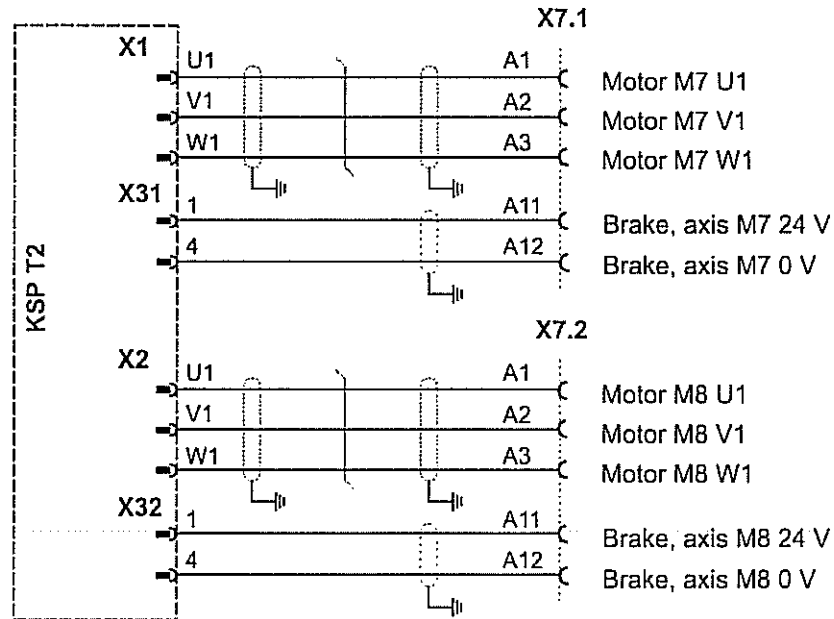


Fig. 8-12: Palletizer, external axes 7 and 8

8.5 Fastening the KUKA smartPAD holder (optional)

- Procedure**
- Fasten the smartPAD holder on the door of the robot controller or on the wall. (>>> 6.4 "Fastening the KUKA smartPAD holder (optional)" Page 62)

8.6 Plugging in the KUKA smartPAD

- Procedure**
- Plug the KUKA smartPAD to X19 on the robot controller.

⚠ WARNING If the smartPAD is disconnected, the system can no longer be switched off by means of the EMERGENCY STOP button on the smartPAD. For this reason, an external EMERGENCY STOP must be connected to the robot controller. The user is responsible for ensuring that the smartPAD is immediately removed from the system when it has been disconnected. The smartPAD must be stored out of sight and reach of personnel working on the industrial robot. This prevents operational and non-operational EMERGENCY STOP facilities from becoming interchanged. Failure to observe these precautions may result in death to persons, severe physical injuries or considerable damage to property.

Connector pin allocation X19

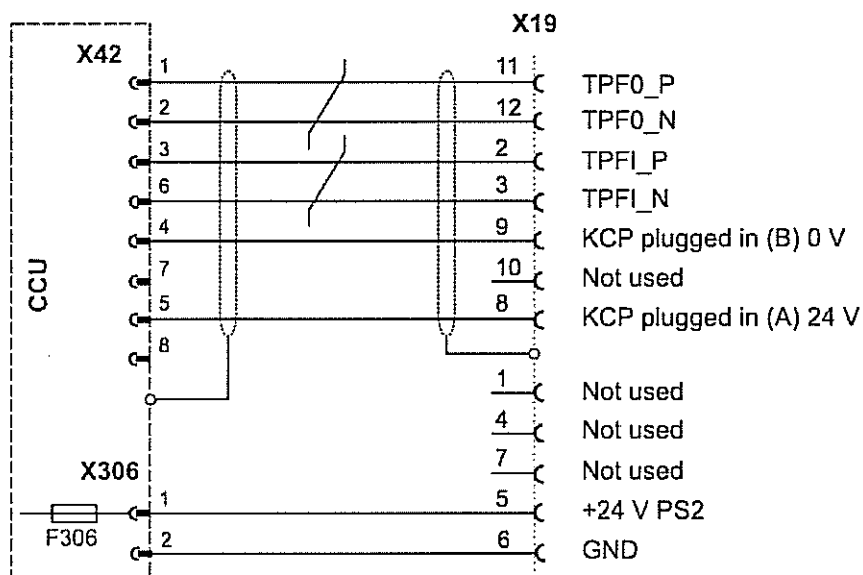


Fig. 8-13: Connector pin allocation X19

8.7 Connecting the PE equipotential bonding

Procedure

1. Connect an additional PE conductor between the central PE rail of the supply cabinet and the PE bolt of the robot controller.
2. Connect a 16 mm² cable as equipotential bonding between the manipulator and the robot controller.
(>>> 6.9 "PE equipotential bonding" Page 77)
3. Carry out a ground conductor check for the entire industrial robot in accordance with DIN EN 60204-1.

8.8 Connecting the robot controller to the power supply

Description

The robot controller is connected to the mains via a Harting connector X1.



CAUTION If the robot controller is connected to a power system without a grounded neutral, this may cause malfunctions in the robot controller and material damage to the power supply units. Electrical voltage can cause physical injuries. The robot controller may only be operated with grounded-neutral power supply systems.

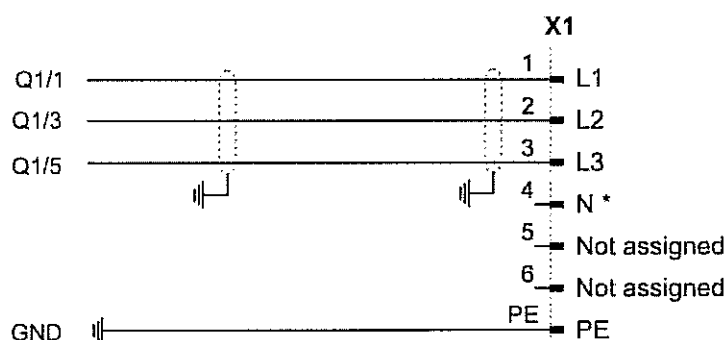


Fig. 8-14: Connector pin allocation X1

N* Option for service socket

Precondition

≡ Robot controller is switched off.

- ▣ The power cable is de-energized.

Procedure ▣ Connect the robot controller to the power supply via X1.

8.9 Reversing the battery discharge protection measures

Description To prevent the batteries from discharging before the controller has been started up for the first time, the robot controller is supplied with connector X305 disconnected from the CCU.

Procedure ▣ Plug connector X305 into the CCU.

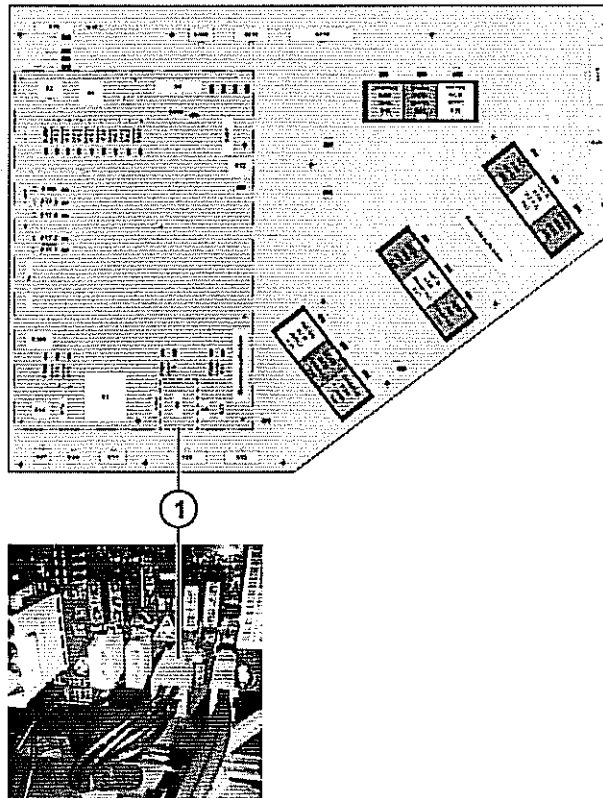


Fig. 8-15: Battery discharge protection X305

1 Connector X305 on the CCU

8.10 Configuring and connecting connector X11

Precondition ▣ Robot controller is switched off.

Procedure

1. Configure connector X11 in accordance with the system and safety concepts. (>>> 6.6 "Description of interface X11" Page 63)
2. Connect interface connector X11 to the robot controller.

NOTICE Connector X11 may only be plugged in or unplugged when the robot controller is switched off. If connector X11 is plugged in or unplugged when energized, damage to property may occur.

8.11 System configuration of the industrial robot modified

Description

The system configuration of the industrial robot must be configured using WorkVisual in the following cases:

- Installation of KSS/VSS 8.2
This is the case if a KSS/VSS 8.2 package is installed without KSS/VSS 8.2 already being present (because it has been uninstalled or deleted or has never been installed).
- The hard drive has been exchanged.
- A device has been replaced by a device of a different type.
- More than one device has been replaced by a device of a different type.
- One or more devices have been removed.
- One or more devices have been added.
- Two or more devices have been interchanged.

8.12 Start-up mode

Description

The industrial robot can be set to Start-up mode via the smartHMI user interface. In this mode, the manipulator can be moved in T1 or CRR mode in the absence of the safety periphery. (CRR is an operating mode specifically for use with SafeOperation.)

- If an SIB interface is used:
Start-up mode is always possible if all input signals have the state "logic zero". If this is not the case, the robot controller prevents or terminates Start-up mode.
- If the PROFIsafe interface is used:
If a connection to a higher-level safety system exists or is established, the robot controller prevents or terminates Start-up mode.

Hazards

Possible hazards and risks involved in using Start-up mode:

- A person walks into the manipulator's danger zone.
- An unauthorized person moves the manipulator.
- In a hazardous situation, a disabled external EMERGENCY STOP device is actuated and the manipulator is not shut down.

Additional measures for avoiding risks in Start-up mode:

- Cover disabled EMERGENCY STOP devices or attach a warning sign indicating that the EMERGENCY STOP device is out of operation.
- If there is no safety fence, other measures must be taken to prevent persons from entering the manipulator's danger zone, e.g. use of warning tape.
- Use of Start-up mode must be minimized – and avoided where possible – by means of organizational measures.



External safeguards are disabled in Start-up mode. Observe the safety instructions relating to Start-up mode.
(>>> 5.8.3.1 "Start-up mode" Page 52)

In Start-up mode, the system switches to the following simulated input image:

- The external EMERGENCY STOP is not active.
- The safety gate is open.
- No safety stop 1 has been requested.
- No safety stop 2 has been requested.
- No safe operational stop has been requested.

- Only for VKR C4: E2 is closed.

If SafeOperation or SafeRangeMonitoring is used, Start-up mode also influences other signals.



Information about the effects of Start-up mode in conjunction with SafeOperation or SafeRangeMonitoring can be found in the documentation **SafeOperation** and **SafeRangeMonitoring**.

Mapping of standard signals

Byte 0: 0100 1110

Byte 1: 0100 0000

SafeOperation or
SafeRangeMoni-
toring signal
mapping

Byte 2: 1111 1111

Byte 3: 1111 1111

Byte 4: 1111 1111

Byte 5: 1111 1111

Byte 6: 1000 0000

Byte 7: 0000 0000

8.13 Switching on the robot controller

Preconditions

- The door of the robot controller is closed.
- All electrical connections are correct and the power supply is within the specified limits.
- It must be ensured that no persons or objects are present within the danger zone of the manipulator.
- All safety devices and protective measures are complete and fully functional.
- The internal temperature of the cabinet must have adapted to the ambient temperature.



We recommend that all motions of the manipulator should be triggered from outside the safety fencing.

Procedure

1. Switch on the mains power to the robot controller.
2. Unlock the EMERGENCY STOP button on the KUKA smartPAD.
3. Switch on the main switch. The control PC begins to run up the operating system and the control software.

9 Operation

9.1 KUKA smartPAD teach pendant

9.1.1 Front view

Function

The smartPAD is the teach pendant for the industrial robot. The smartPAD has all the operator control and display functions required for operating and programming the industrial robot.

The smartPAD has a touch screen: the smartHMI can be operated with a finger or stylus. An external mouse or external keyboard is not necessary.



The general term "KCP" (KUKA Control Panel) is often used in this documentation for the smartPAD.

Overview

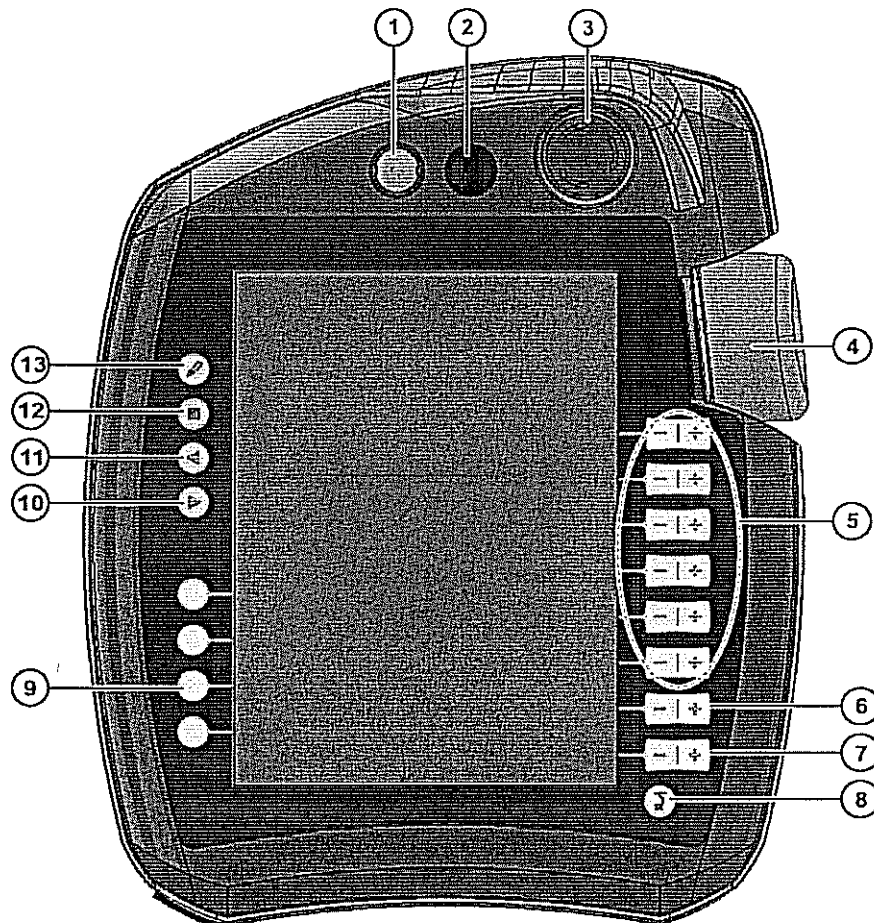


Fig. 9-1: KUKA smartPAD, front view

9.1.2 Rear view

Overview

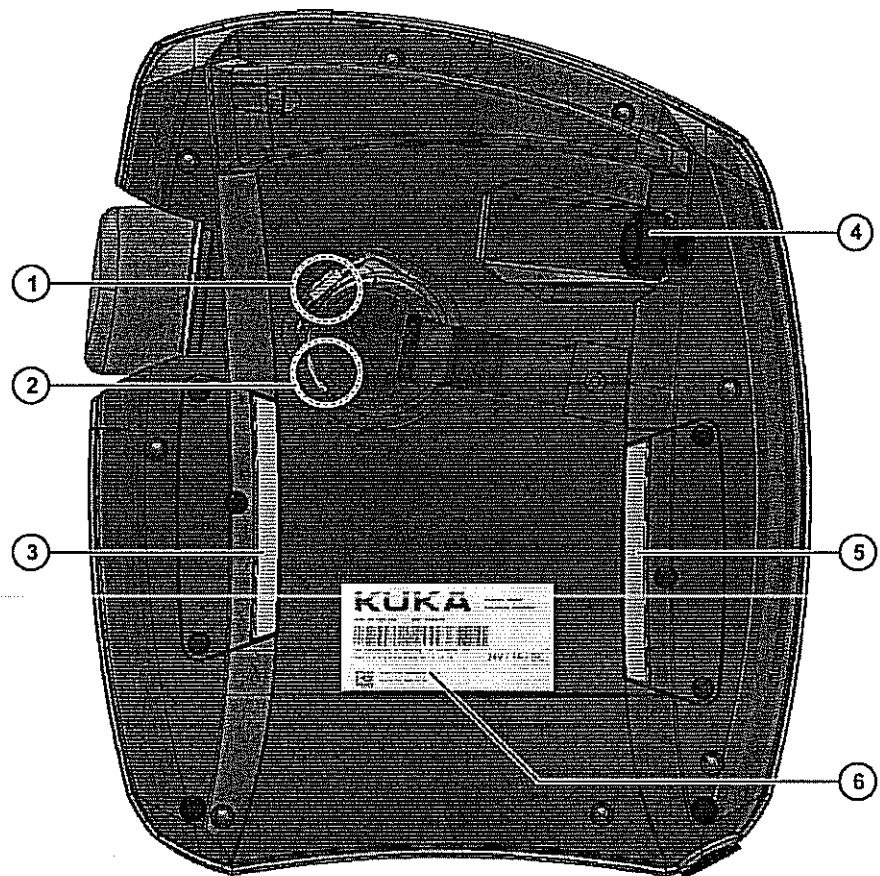


Fig. 9-2: KUKA smartPAD, rear view

- | | | | |
|---|-------------------|---|----------------------|
| 1 | Enabling switch | 4 | USB connection |
| 2 | Start key (green) | 5 | Enabling switch |
| 3 | Enabling switch | 6 | Identification plate |

Description

Element	Description
Identification plate	Identification plate
Start key	The Start key is used to start a program.
Enabling switch	The enabling switch has 3 positions: ■ Not pressed ■ Center position ■ Panic position The enabling switch must be held in the center position in operating modes T1 and T2 in order to be able to jog the manipulator. In the operating modes Automatic and Automatic External, the enabling switch has no function.
USB connection	The USB connection is used, for example, for archiving and restoring data. Only for FAT32-formatted USB sticks.

10 Maintenance

Description

Maintenance work must be performed at the specified maintenance intervals after commissioning by the customer.

Maintenance symbols



Oil change



Lubricate with grease gun



Lubricate with brush



Tighten screw/nut



Check component, visual inspection



Clean component



Exchange battery

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.

WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- The power cable is de-energized.
- Observe the ESD guidelines.

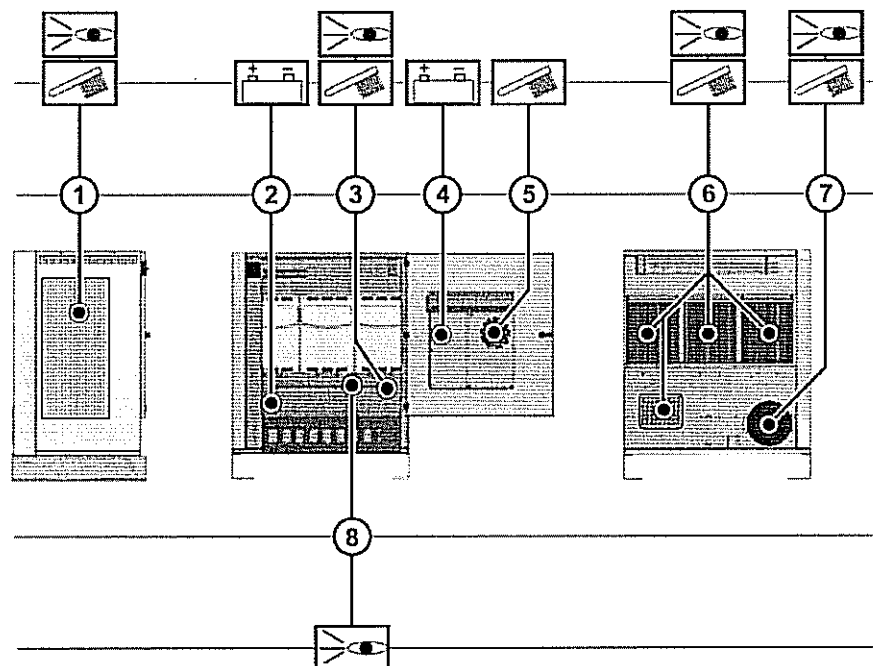


Fig. 10-1: Maintenance points

Interval	Item	Activity
6 months	8	Check the utilized relay outputs of the SIB and/or Extended SIB for correct functioning (>>> 10.1 "Checking SIB relay outputs" Page 106) (>>> 10.2 "Checking Extended SIB relay outputs" Page 107)
1 year at the latest	7	Depending on installation conditions and degree of fouling, clean the protective grille of the external fan with a brush.
2 years at the latest	1	Depending on installation conditions and degree of fouling, clean the heat exchanger with a brush
	6	Depending on installation conditions and degree of fouling, clean the heat sinks of the KPP, KSP and low-voltage power supply unit with a brush
	7	Depending on installation conditions and degree of fouling, clean the external fans with a brush.
5 years	4	Exchange the motherboard battery
5 years (with 3-shift operation)	5	Exchange the control PC fans (>>> 11.3.2 "Exchanging the control PC fan" Page 114)
	7	Exchange the external fan (>>> 11.2 "Exchanging the external fan" Page 109)
as indicated by the battery monitoring	2	Exchange the batteries (>>> 11.5 "Exchanging the batteries" Page 130)
When pressure relief plug becomes discolored	3	Depends on installation conditions and degree of fouling. Visual inspection of the pressure relief plug: change filter insert if discolored (original color: white) (>>> 11.7 "Exchanging the pressure relief plug" Page 133)

Once an activity from the maintenance list has been carried out, a visual inspection must be made, with special attention to the following points:

- Check that fuses, contactors, plug-in connections and boards are fitted securely.
- Damage to cabling.
- Check PE equipotential bonding connection.
- Wear and damage to any system components.

10.1 Checking SIB relay outputs

Activity Check the function of the output "Local Emergency Stop".

Procedure ■ Press the Local EMERGENCY STOP button.

Activity Check the function of the output "Operator safety acknowledged".

Procedure

1. Set operating mode to Automatic or Automatic External.
2. Open operator safety (safeguard).

Activity Check the function of the output "Switch on periphery".

Procedure

1. Set operating mode to Automatic or Automatic External.
2. Open operator safety (safeguard).
3. Release enabling switch in "T1" or "T2" mode.

If no error message is displayed, the relay outputs are OK.

10.2 Checking Extended SIB relay outputs

Activity Check the alarm space outputs.

Procedure  Violate the corresponding alarm space. Depending on the configuration of the alarm space, the Cartesian or axis-specific alarm space can be violated.



In normal operation, the alarm space outputs are checked cyclically within the test interval (6 months) by the production operation.

Activity Check the output "SafeOperation active".

Procedure  Deactivate SafeOperation or SafeRangeMonitoring.

Activity Check the output "Robot referenced".

Procedure  Switch the drive bus off and back on again.
If no error message is displayed, the relay outputs are OK.

10.3 Cleaning the robot controller

Preconditions  The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
 The controller has been shut down.
 The power cable is de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

 Observe the ESD guidelines.

Work regulations  The manufacturer's instructions must be observed when using cleaning agents for cleaning work.
 It must be ensured that no cleaning agents enter electrical components.
 Do not use compressed air during cleaning work.
 Do not spray with water.

Procedure 1. Loosen and vacuum up any dust deposits.
2. Clean robot controller with a cloth soaked with a mild cleaning agent.
3. Clean cables, plastic parts and hoses with a solvent-free cleaning agent.
4. Replace damaged, illegible or missing inscriptions, labels and plates.

11 Repair

11.1 Repair and procurement of spare parts

Repair	Repairs to the robot controller may only be carried out by KUKA customer support personnel or by customers who have taken part in a relevant course of training held by KUKA Roboter GmbH. Repairs within modules may only be carried out by specially trained KUKA Roboter GmbH personnel.
Procurement of spare parts	The article numbers of the spare parts are listed in the spare parts catalog. KUKA Roboter GmbH supplies the following types of spare parts for repairs to the robot controller: ■ New parts Once the new part has been installed, the part that has been removed can be disposed of. ■ Exchange parts Once the exchange part has been installed, the part that has been removed is returned to KUKA Roboter GmbH.

 A "Robot Repair Card" is supplied with the exchange parts. The Repair Card must be completed and returned to KUKA Roboter GmbH.

11.2 Exchanging the external fan

Preconditions	■ The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again. ■ The power cable must be de-energized.
----------------------	--

 **WARNING** Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.

Procedure	1. Unplug fan connector X14 on the CCU. 2. Remove the rear panel.
------------------	--

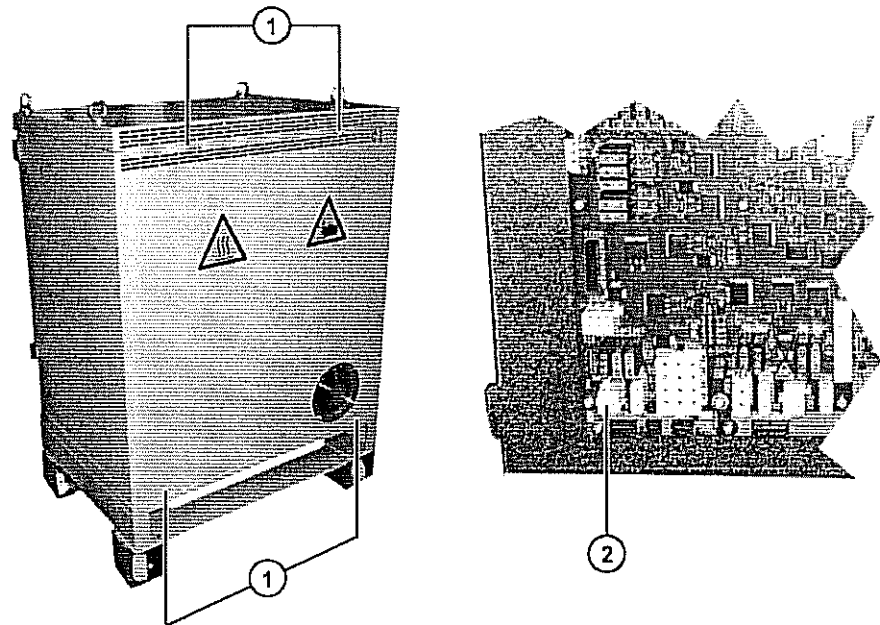


Fig. 11-1: Exchanging the external fan

- 1 Fastening of rear panel
- 2 Fan connector X14 on the CCU
3. Remove the screws of the cable inlet.
4. Swivel back the cable inlet and pull out the connecting cable.

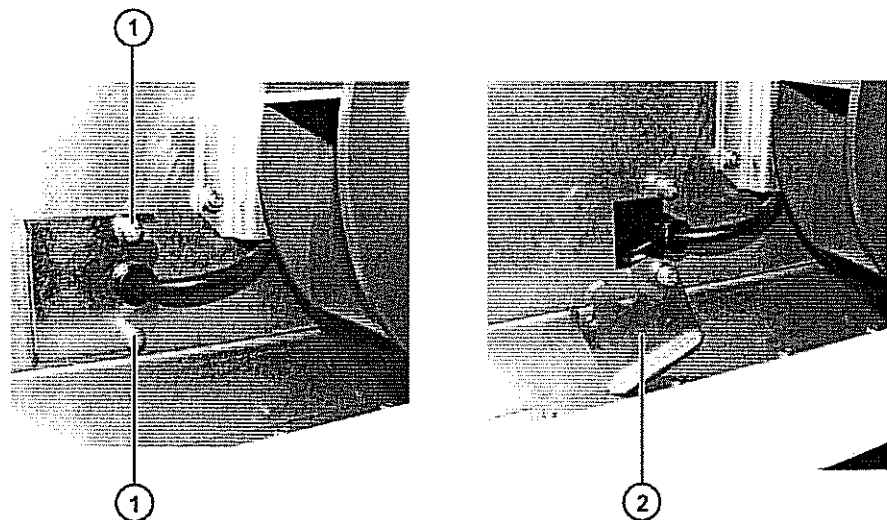


Fig. 11-2: Exchanging the external fan

- 1 Fastening of cable inlet
- 2 Cover of the cable inlet
5. Remove the fan holder together with the fan.
6. Install the new fan together with its holder and fasten.

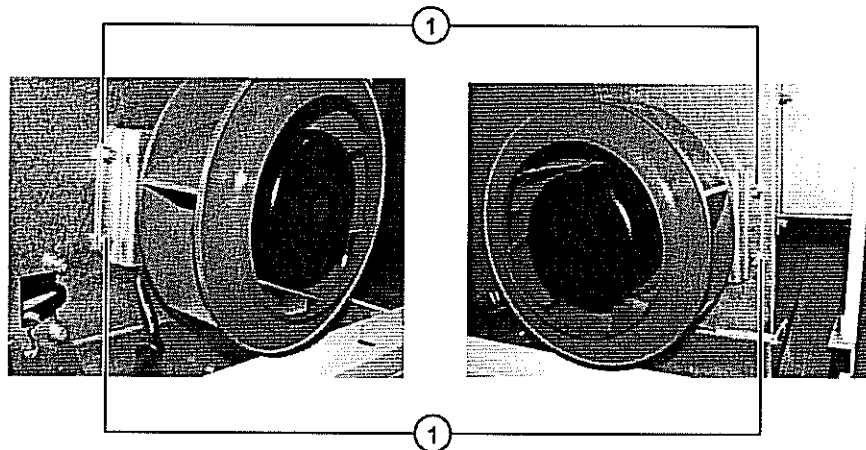


Fig. 11-3: Exchanging the external fan

- 1 Fastening of the fan holder
7. Route the connecting cable in the cabinet.
8. Mount the cable inlet.
9. Insert and fasten the rear panel
10. Plug in fan connector X14 on the CCU.

11.3 Control PC

Overview

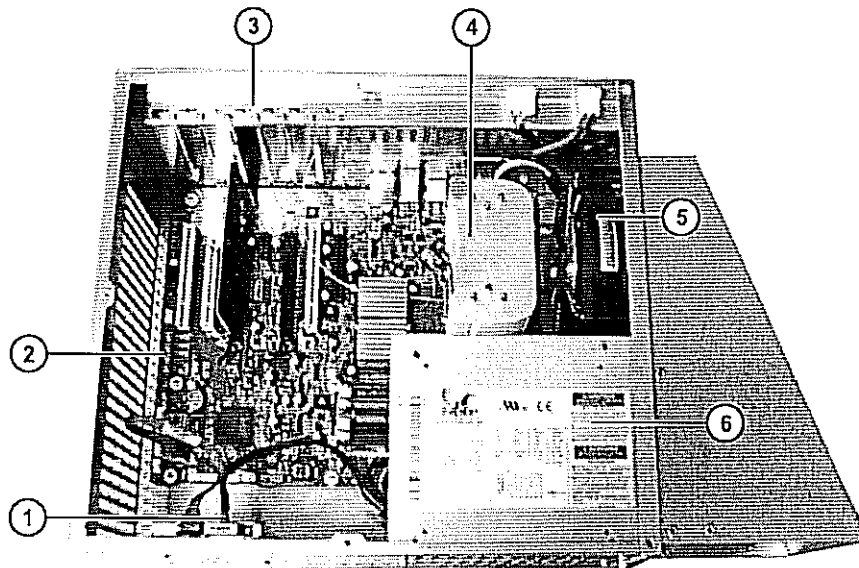


Fig. 11-4: Overview of the control PC

- | | |
|-----------------|------------------------|
| 1 Hard drive | 4 Processor heat sink |
| 2 Motherboard | 5 PC fan |
| 3 PC interfaces | 6 PC power supply unit |

Interfaces

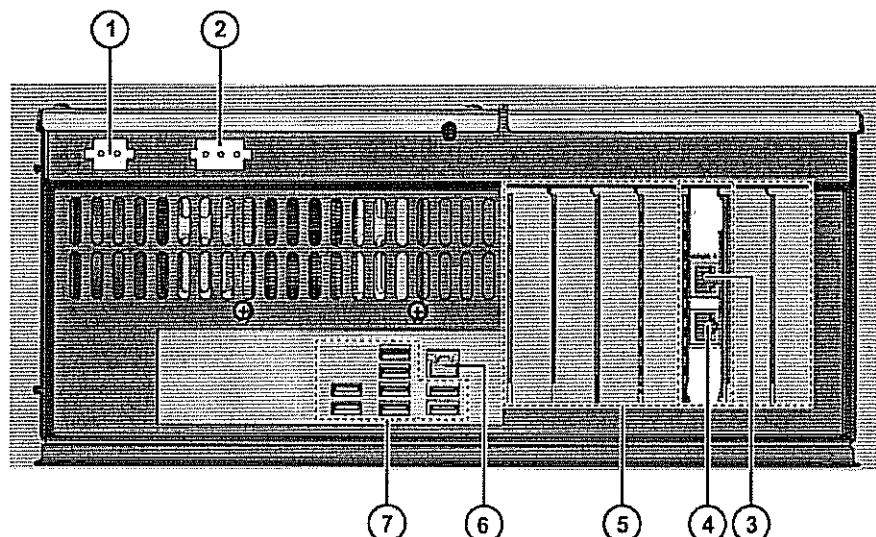


Fig. 11-5: Control PC interfaces

Item	Interface	Item	Interface
1	Connector X961, power supply DC 24 V	5	Field bus cards, slots 1 to 7
2	Connector X962, PC fan	6	LAN Onboard KUKA System Bus
3	LAN Dual NIC KUKA Controller Bus	7	8 USB 2.0 ports
4	LAN Dual NIC KUKA Line Interface		

Slot assignment

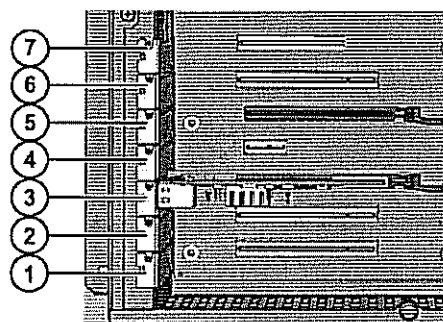


Fig. 11-6: PC slot assignment

The PC slots can be fitted with the following plug-in cards:

Slot	Designation	Plug-in card
1	PCI1	Field bus
2	PCI2	Field bus
3	PCIe16	LAN Dual NIC
4	PCIe1	Not assigned
5	PCIe16	GK (optional)
6	PCI3	Field bus
7	PCIe4	Not assigned

Motherboard

The following components are located on the motherboard:

- Processor
- Memory modules
- Interfaces to all PC components
- On-board network card

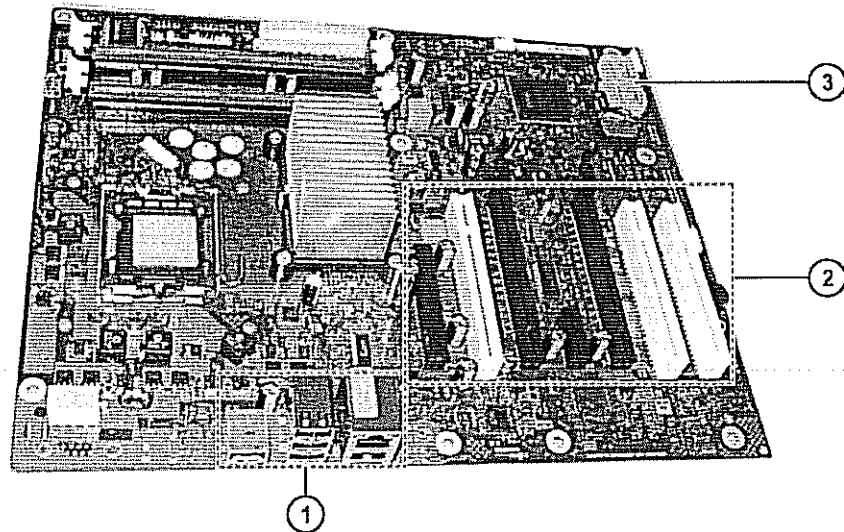


Fig. 11-7: Motherboard connections

- 1 PC interfaces, on-board network and USB
- 2 PC slots
- 3 SATA connections



KUKA Roboter GmbH has assembled, tested and supplied the motherboard with an optimum configuration. No liability will be accepted for modifications to the configuration that have not been carried out by KUKA Roboter GmbH.

11.3.1 Exchanging the control PC

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- The power cable must be de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.

Procedure

1. Unplug the power supply and all connections to the control PC.
2. Slacken the knurled nuts.
3. Remove the control PC and lift it out towards the top.
4. Insert the new control PC and fasten.
5. Plug in the connections.

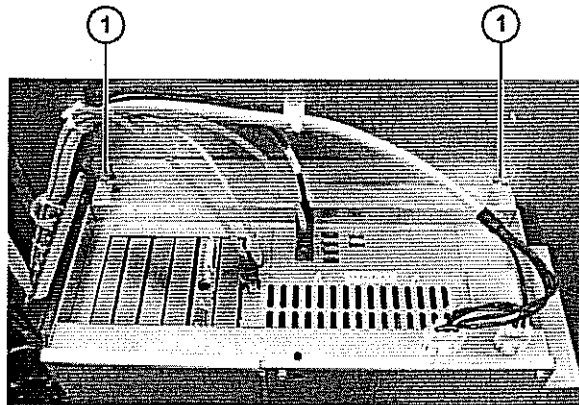


Fig. 11-8: Fastening of control PC

1 Knurled nut

11.3.2 Exchanging the control PC fan

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- The power cable must be de-energized.



WARNING

Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.

Procedure

1. Remove the control PC. (>>> 11.3.1 "Exchanging the control PC" Page 113)
2. Remove the air duct.
3. Remove the cover of the control PC.
4. Release and unplug the fan connector.

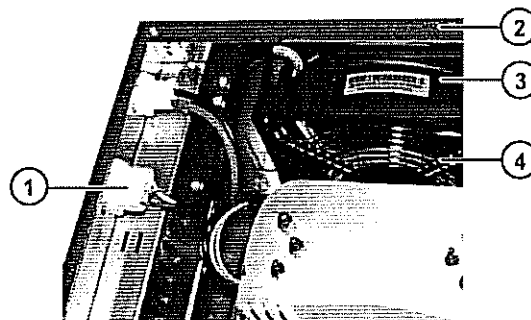


Fig. 11-9: Unplugging the control PC fan

- | | |
|----------------------|--------------|
| 1 Fan connector | 3 Fan |
| 2 Control PC housing | 4 Fan grille |

5. Remove outer fan grille.
6. Pull the fan inwards off the mounting plugs.
7. Remove the expanding rivets and take off the fan grille.

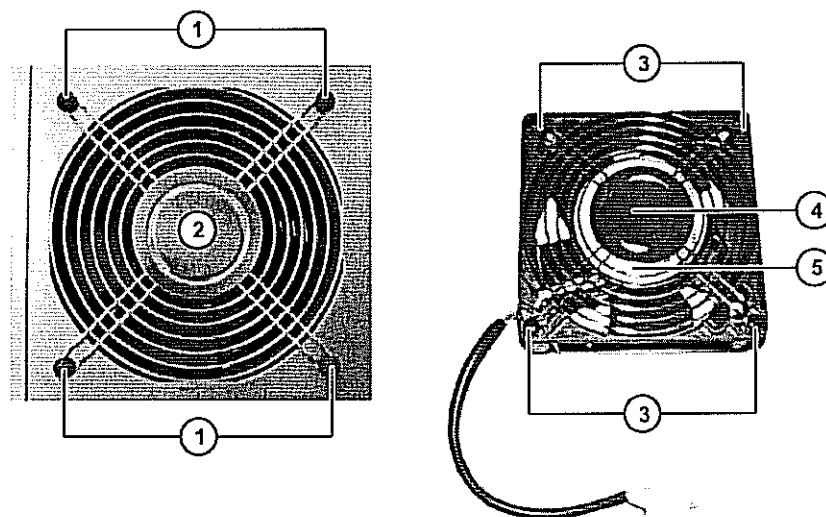


Fig. 11-10: PC fan configuration

- | | |
|--|----------------------------|
| 1 Mounting plugs | 4 Fan grille |
| 2 Outer fan grille | 5 Fan identification plate |
| 3 Fastening of fan grille (expanding rivets) | |

8. Fasten the fan grille to the new fan with the expanding rivets.



The fan grille must be fastened to the side with the identification plate. See (>>> Fig. 11-10).

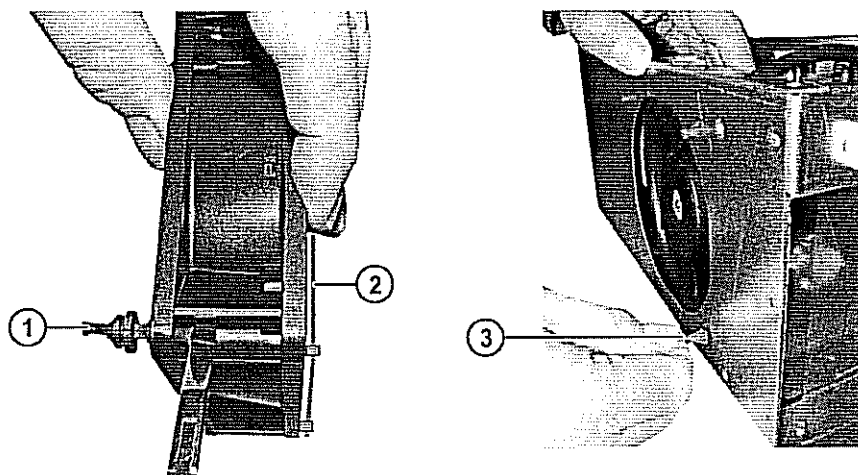


Fig. 11-11: Installing the control PC fan

- | | |
|-----------------------------|------------------------------------|
| 1 Mounting plugs on the fan | 3 Mounting plugs on the PC housing |
| 2 Fan grille | |

9. Install the mounting plugs in the fan.
10. Insert the fan into the PC housing and pull the mounting plugs through the PC housing.
11. Reattach outer fan grille.
12. Install the air duct.

11.3.3 Exchanging the motherboard

A defective motherboard is not exchanged separately, but together with the control PC.

11.3.4 Exchanging the motherboard battery

The battery on the motherboard of the control PC may only be exchanged by authorized maintenance personnel in consultation with the KUKA customer support service.

11.3.5 Exchanging the Dual NIC network card

- Preconditions**
- ⇒ The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
 - ⇒ The power cable must be de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- ⇒ Observe the ESD guidelines.

Procedure

1. Open the PC chassis.
2. Unplug the connections to the dual NIC network card.
3. Release the fastenings of the card and pull the card out of the slot.
4. Inspect the new dual NIC network card for mechanical damage.
5. Plug the dual NIC network card into its slot and tighten the fastening screws.
6. Plug in the connections to the card.

11.3.6 Exchanging the hard drive

- Preconditions**
- ⇒ The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
 - ⇒ The power cable must be de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- ⇒ Observe the ESD guidelines.

Procedure

1. Release and unplug the SATA connector.
2. Unplug the power supply connector.
3. Unscrew the knurled screws.
4. Exchange the hard drive for a new one.
5. Plug in the SATA and power supply connectors
6. Fasten the hard drive with the knurled screws.
7. Install the operating system and the KUKA System Software (KSS).
8. The system configuration of the industrial robot must be configured using WorkVisual.



Once the hard drive has been exchanged, the archive of the previous installation can be loaded (as an alternative to configuration using WorkVisual).

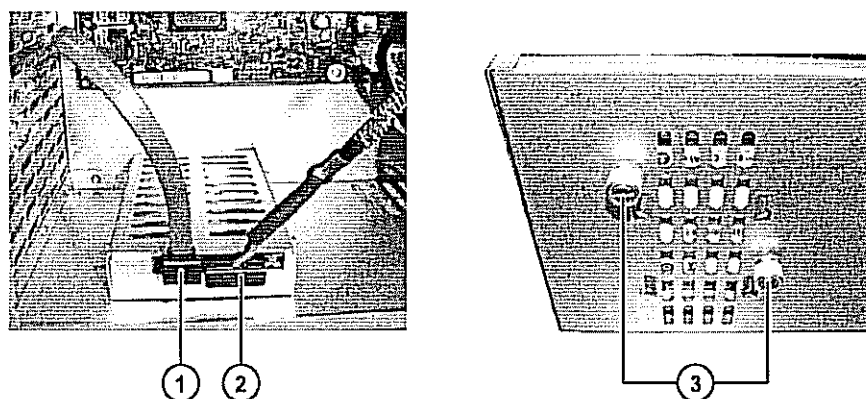


Fig. 11-12: Exchanging the hard drive

- 1 SATA connection
- 2 Power supply connection
- 3 Knurled screws on the underside

11.4 Modifying the system configuration, exchanging devices

Description

The system configuration of the industrial robot must be configured using WorkVisual in the following cases:

- Installation of KSS/VSS 8.2
This is the case if a KSS/VSS 8.2 package is installed without KSS/VSS 8.2 already being present (because it has been uninstalled or deleted or has never been installed).
- The hard drive has been exchanged.
- A device has been replaced by a device of a different type.
- More than one device has been replaced by a device of a different type.
- One or more devices have been removed.
- One or more devices have been added.
- Two or more devices have been interchanged.

Exchanging devices

If a device is exchanged, at least one KCB, KSB or KEB device is replaced by a device of the same type. Any number of KCB, KSB and KEB devices can be exchanged until all devices in the KCB, KSB and KEB have been replaced simultaneously by devices of the same type. Simultaneous exchange of two identical components of the KCB is not possible. Only one of the identical components may be exchanged at any one time.



The interchanging of 2 identical devices can only occur in the case of the KSP3x40 if the current system configuration contains 2 KSP3x40.

11.4.1 Exchanging the KUKA Power Pack

Connections

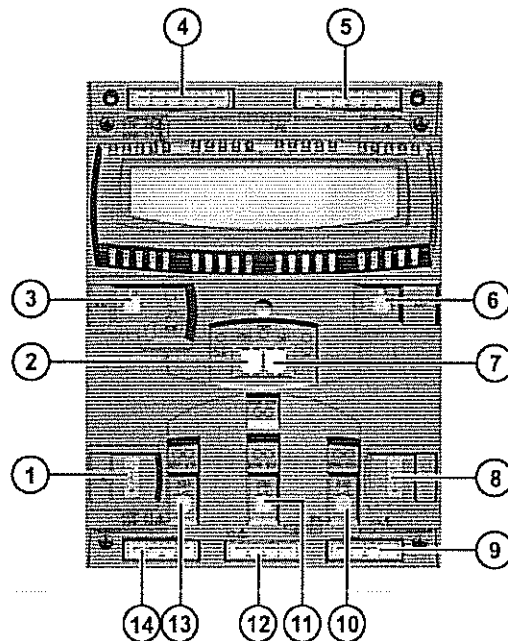


Fig. 11-13: KPP connection with amplifiers for 2 axes

Item	Connector	Description
1	X30	Brakes power supply OUT
2	X20	Drive bus OUT
3	X10	Control electronics power supply OUT
4	X7	Ballast resistor
5	X6	DC link OUT
6	X11	Control electronics power supply IN
7	X21	Drive bus IN
8	X34	Brakes power supply IN
9	X3	Motor connection 3, axis 8
10	X33	Brake connection 3, axis 8
11	X32	Brake connection 2, axis 7
12	X2	Motor connection 2, axis 7
13	-	Not used
14	X4	AC power supply connection and PE

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.

CAUTION

If removal is performed immediately after the robot controller has been shut down, the heat sink surface temperatures are likely to be high and could result in burn injuries. Protective gloves must be worn.

- The power cable is de-energized.

WARNING

Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.

- Wait 5 minutes until the intermediate circuit has discharged.

⚠ WARNING The following components may remain energized (50-780 V) up to 5 minutes after the robot controller has been switched off:

- the KPP
- the KSPs
- the intermediate circuit connecting cables

This voltage can cause life-threatening injuries.

Procedure

1. Unlock connectors X20 and X21 of the data cables. Unplug all connections to the KPP.

⚠ NOTICE Unplugging the data cable connectors without first unlocking them damages the connectors. Unlock the connectors before unplugging them.

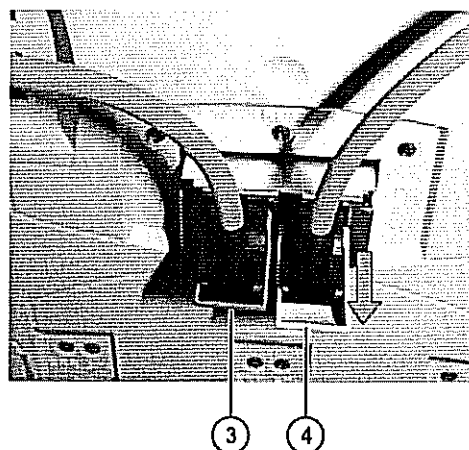
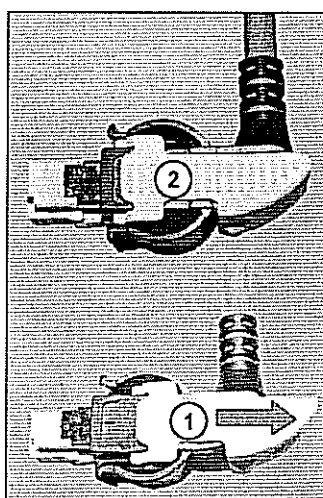


Fig. 11-14: Unlocking connectors X20 and X21

- | | |
|----------------------|-------------------------------------|
| 1 Connector unlocked | 3 Connector plugged in and locked |
| 2 Connector locked | 4 Connector plugged in and unlocked |

2. Slacken the Allen screws.

⚠ CAUTION The KPP weighs approx. 10 kg. When removing or installing the KPP, care must be taken to avoid injury by crushing. Protective gloves must be worn.

3. Lift the KPP slightly, tilt the top forwards and lift the KPP out of the support bracket.
4. Insert the new KPP into the support bracket, hook it on at the top and tighten the fastening screws (tightening torque 4 Nm).
5. Plug in all the connections in accordance with the connector and cable labeling. Lock connectors X20 and X21.
6. If exchanging the device resulted in a system modification, the system configuration of the industrial robot must be configured using WorkVisual.

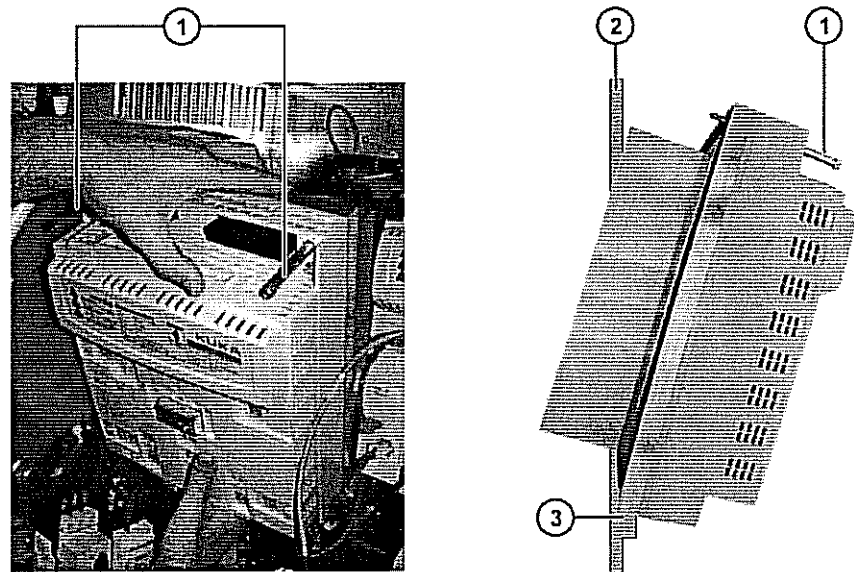


Fig. 11-15: KPP fastening

- 1 Allen screws
- 2 Rear panel of cabinet
- 3 Support bracket

11.4.2 Exchanging the KUKA Servo Pack

Connections

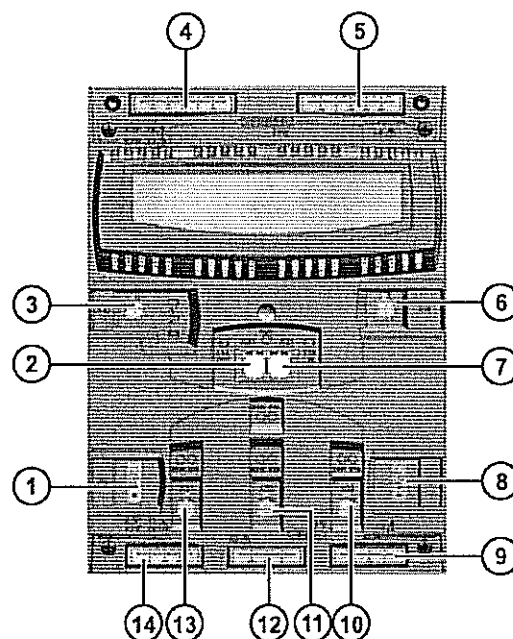


Fig. 11-16: KSP connection with amplifiers for 3 axes

Item	Connector	Description
1	X30	Brakes power supply OUT
2	X20	Drive bus OUT
3	X10	Control electronics power supply OUT
4	X5	DC link OUT
5	X6	DC link IN
6	X11	Control electronics power supply IN

Item	Connector	Description
7	X21	Drive bus IN
8	X34	Brakes power supply IN
9	X3	Motor connection 3
10	X33	Connection, brake 3
11	X32	Connection, brake 2
12	X2	Motor connection 2
13	X31	Connection, brake 1
14	X1	Motor connection 1

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.

CAUTION If removal is performed immediately after the robot controller has been shut down, the heat sink surface temperatures are likely to be high and could result in burn injuries. Protective gloves must be worn.

- The power cable is de-energized.

WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.
- Wait 5 minutes until the intermediate circuit has discharged.

WARNING The following components may remain energized (50-780 V) up to 5 minutes after the robot controller has been switched off:

- the KPP
- the KSPs
- the intermediate circuit connecting cables

This voltage can cause life-threatening injuries.

Procedure

1. Unlock connectors X20 and X21 of the data cables. Unplug all connections to the KSP.

NOTICE Unplugging the data cable connectors without first unlocking them damages the connectors. Unlock the connectors before unplugging them.

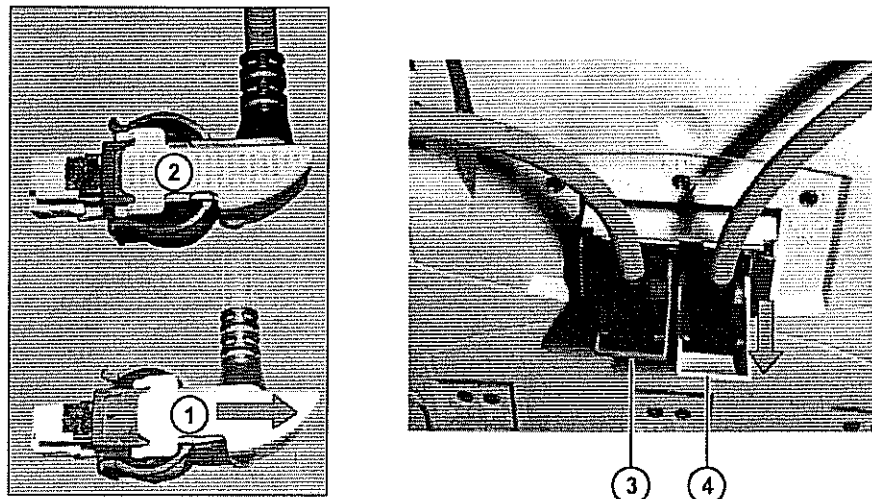


Fig. 11-17: Unlocking connectors X20 and X21

- | | |
|----------------------|---|
| 1 Connector unlocked | 3 Connector X21 plugged in and locked |
| 2 Connector locked | 4 Connector X20 plugged in and unlocked |

2. Slacken the Allen screws.

CAUTION

The KPP weighs approx. 10 kg. When removing or installing the KPP, care must be taken to avoid injury by crushing. Protective gloves must be worn.

3. Lift the KSP slightly, tilt the top forwards and lift the KPP out of the support bracket.
4. Insert the new KSP into the support bracket, hook it on at the top and tighten the fastening screws (tightening torque 4 Nm).
5. Plug in all the connections in accordance with the connector and cable labeling. Lock connectors X20 and X21.
6. If exchanging the device resulted in a system modification, the system configuration of the industrial robot must be configured using WorkVisual.

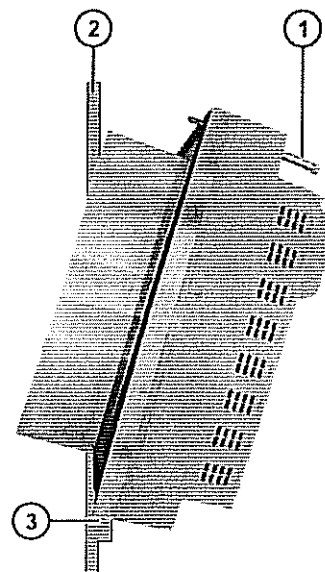
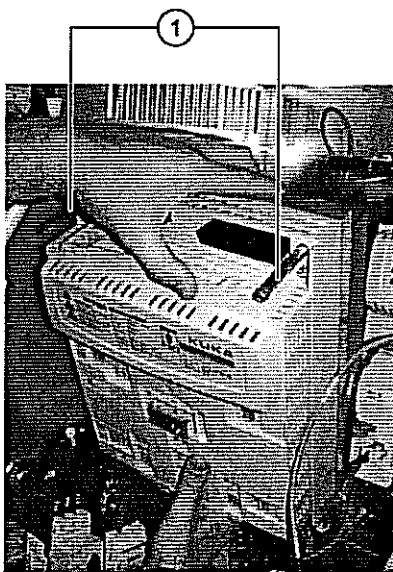


Fig. 11-18: KSP fastening

- 1 Allen screws
- 2 Rear panel of cabinet
- 3 Support bracket

11.4.3 Exchanging the Cabinet Control Unit

Connections

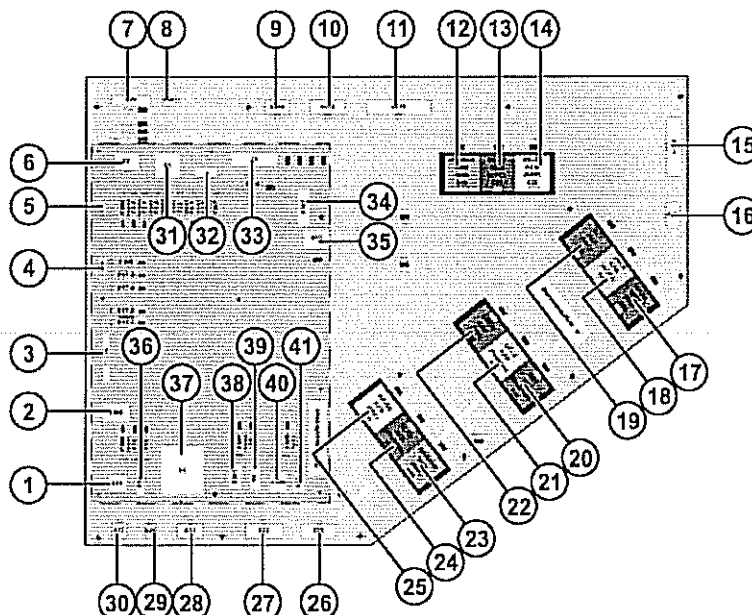


Fig. 11-19: Connections on the CCU

Item	Con- nector	Description
1	X14	External fan connection
2	X308	External power supply, safety circuit
3	X1700	Board connection
4	X306	KCP power supply
5	X302	SIB power supply
6	X3	KPP1 power supply
7	X29	EDS connection, memory card
8	X30	Ballast resistor temperature monitoring
9	X309	Main contactor 1 (HSn, HSRn)
10	X312	Main contactor 2 (HSn, HSRn)
11	X310	Spare (safe input 2/3, safe output 2/3)
12	X48	Safety Interface Board SIB (orange)
13	X31	Controller bus, KPC (blue)
14	X32	Controller bus, KPP (white)
15	X311	Safe inputs, ZSE1, ZSE2; NHS (jumper plug)
16	X28	Mastering test
17	X43	KUKA Service Interface (KSI) (green)
18	X42	KUKA Operator Panel Interface KCP (yellow)
19	X41	KUKA System Bus, KPC (red)
20	X44	EtherCAT Interface (KUKA Extension Bus) (red)
21	X47	Spare (yellow)
22	X46	KUKA System Bus, RoboTeam (green)
23	X45	KUKA System Bus, RoboTeam (orange)

Item	Connector	Description
24	X34	Controller bus, RDC (blue)
25	X33	Controller bus, spare (white)
26	X25	Fast Measurement inputs 7-8
27	X23	Fast Measurement inputs 1-6
28	X11	Alarm contact for main switch
29	X26	Thermostatic switch for transformer
30	X27	Alarm contact for cooling unit
31	X5	KPP2 power supply
32	X22	Cabinet lighting (optional)
33	X4	KPC, KPP, internal fan power supply
34	X307	CSP power supply
35	X12	USB
36	X15	Internal cabinet fan (optional)
37	X1	Infeed from low-voltage power supply
38	X301	24 V without battery backup, switched load voltage US2 (F301)
39	X6	24 V without battery backup, unswitched load voltage US1 (F6)
40	X305	Battery
41	X21	RDC power supply

Preconditions

- ≡ The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- ≡ The power cable is de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- ≡ Observe the ESD guidelines.
- ≡ Wait 5 minutes until the intermediate circuit has discharged.



WARNING The following components may remain energized (50-780 V) up to 5 minutes after the robot controller has been switched off:

- ≡ the KPP
 - ≡ the KSPs
 - ≡ the intermediate circuit connecting cables
- This voltage can cause life-threatening injuries.

Procedure

1. Unlock the data cable connectors. Unplug all connections to the CCU.



NOTICE Unplugging the data cable connectors without first unlocking them damages the connectors. Unlock the connectors before unplugging them.

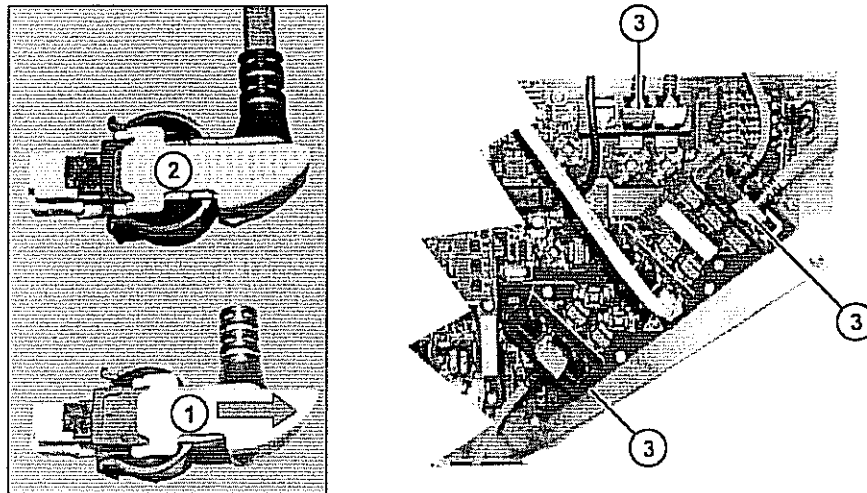


Fig. 11-20: Unlocking the data cable connectors

- | | |
|---|--|
| <p>1 Connector unlocked</p> <p>2 Connector locked</p> | <p>3 Connector plugged in and locked</p> |
|---|--|
2. Remove the screw on the fastening plate and pull the plate with the CCU out of the tab slots.
 3. Check the new CCU for mechanical damage. Insert the fastening plate with the CCU into the tab slots and screw it firmly in place.
 4. Plug in all the connections in accordance with the connector and cable labeling. Lock the data cable connectors.

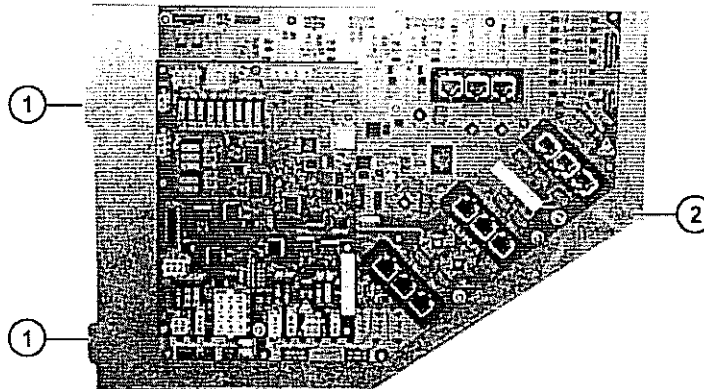


Fig. 11-21: CCU fastening

- 1 Tabs
- 2 Fastening screw

11.4.4 Exchanging the Safety Interface Board

Standard connections

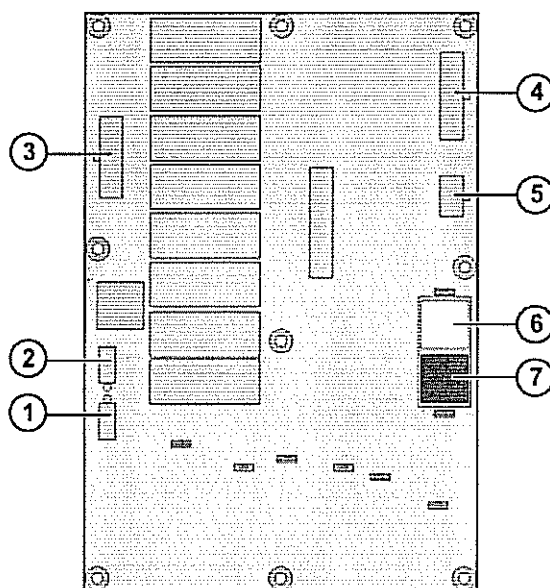


Fig. 11-22: Standard SIB connections

Item	Connector	Description
1	X250	SIB power supply
2	X251	Power supply for additional components
3	X252	Safe outputs
4	X253	Safe inputs
5	X254	Safe inputs
6	X258	KUKA System Bus IN
7	X259	KUKA System Bus OUT

Extended connections

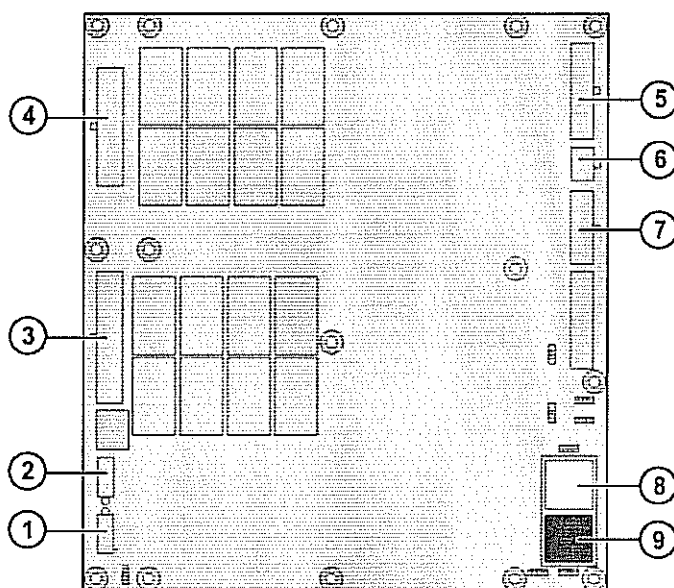


Fig. 11-23: Extended SIB connections

Item	Con- nector	Description
1	X260	Extended SIB power supply
2	X261	Power supply for additional components
3	X264	Safe outputs 1 and 4
4	X266	Safe outputs 5 to 8
5	X262	Safe inputs
6	X263	Safe inputs
7	X267	Safe inputs
8	X268	KUKA System Bus IN
9	X269	KUKA System Bus OUT

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- The power cable is de-energized.

⚠ WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.
- Wait 5 minutes until the intermediate circuit has discharged.

⚠ WARNING The following components may remain energized (50-780 V) up to 5 minutes after the robot controller has been switched off:

- the KPP
- the KSPs
- the intermediate circuit connecting cables

This voltage can cause life-threatening injuries.

Procedure

1. Unlock the data cable connectors. Unplug all connections to the SIB.

NOTICE Unplugging the data cable connectors without first unlocking them damages the connectors. Unlock the connectors before unplugging them.

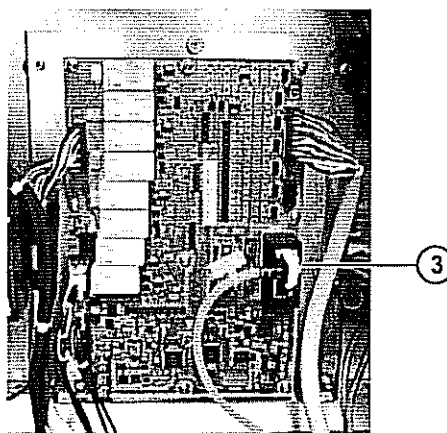
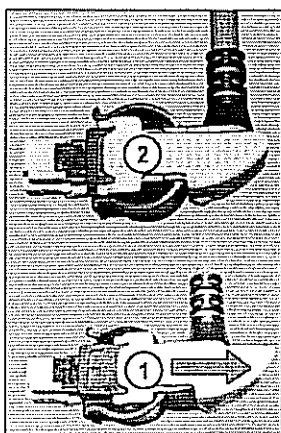


Fig. 11-24: Unlocking the data cable connectors

- | | |
|----------------------|-----------------------------------|
| 1 Connector unlocked | 3 Connector plugged in and locked |
| 2 Connector locked | |

2. Remove the screw on the fastening plate and pull the plate with the SIB out of the tab slots.
3. Check the new SIB for mechanical damage. Insert the fastening plate with the SIB into the tab slots and screw it firmly in place.
4. Plug in all the connections in accordance with the connector and cable labeling. Lock the data cable connectors.
5. If exchanging the SIB resulted in a system modification, the system configuration of the industrial robot must be configured using WorkVisual.

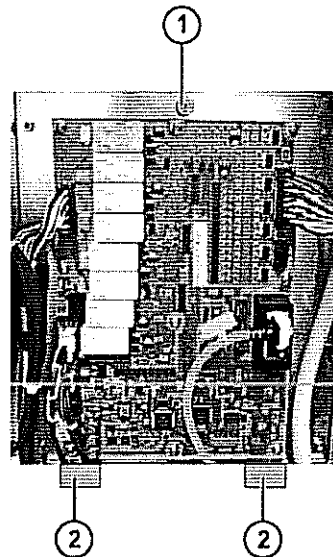


Fig. 11-25: SIB with fastening plate

- 1 Fastening screw
- 2 Tabs

11.4.5 Exchanging the Resolver Digital Converter

Connections

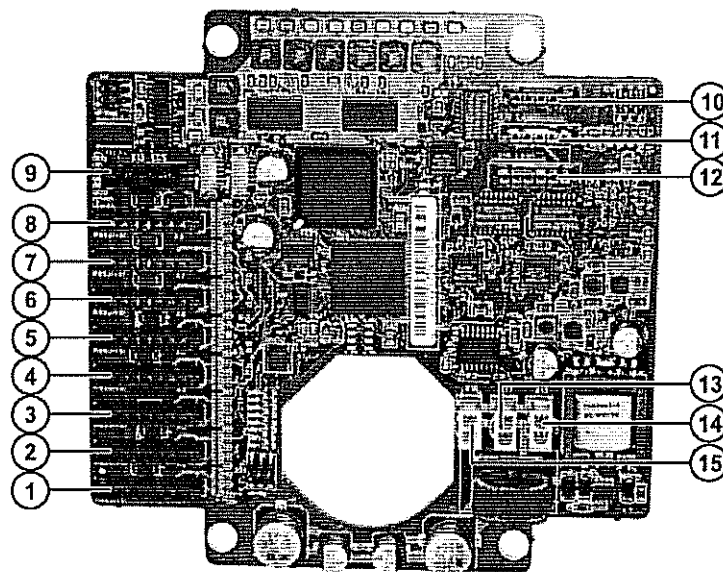


Fig. 11-26: Overview of RDC connections

Item	Connector	Description
1	X1	Resolver connection, axis 1
2	X2	Resolver connection, axis 2
3	X3	Resolver connection, axis 3
4	X4	Resolver connection, axis 4
5	X5	Resolver connection, axis 5
6	X6	Resolver connection, axis 6
7	X7	Resolver connection, axis 7
8	X8	Resolver connection, axis 8
9	X13	EDS connection, memory card, RDC
10	X20	EMD
11	X19	KCB OUT
12	X18	KCB IN
13	X17	EMD power supply
14	X15	Power supply IN
15	X16	Power supply OUT (next KCB device)

Preconditions

- ≡ The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- ≡ The power cable must be de-energized.



WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- ≡ Observe the ESD guidelines.

Procedure

1. Remove the screws from the lid of the RDC box.

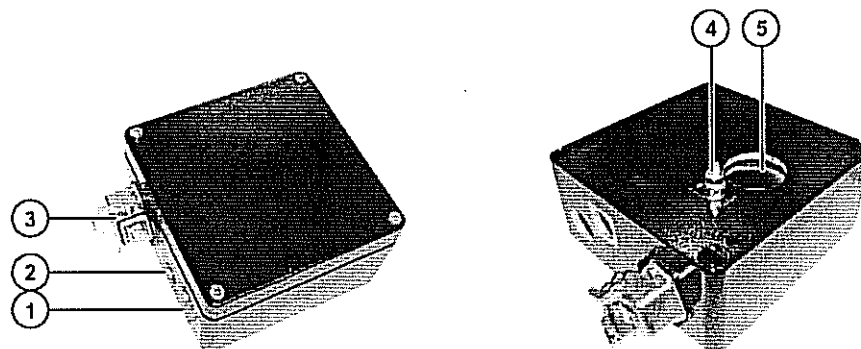


Fig. 11-27: RDC box with lid

- 1 Union for 2 external axis control cables X7 and X8
 - 2 EMD connection X32
 - 3 Data cable X31
 - 4 Bolt for ground conductor connection
 - 5 Cable inlet for resolver connections X1-X6
2. Carefully disconnect all cables and bend them out of the way to the sides.
 3. Carefully unplug the EDS connection.



The EDS memory is not removed and remains in the RDC box when the RDC is exchanged.

4. Remove the fastening screws of the RDC module.

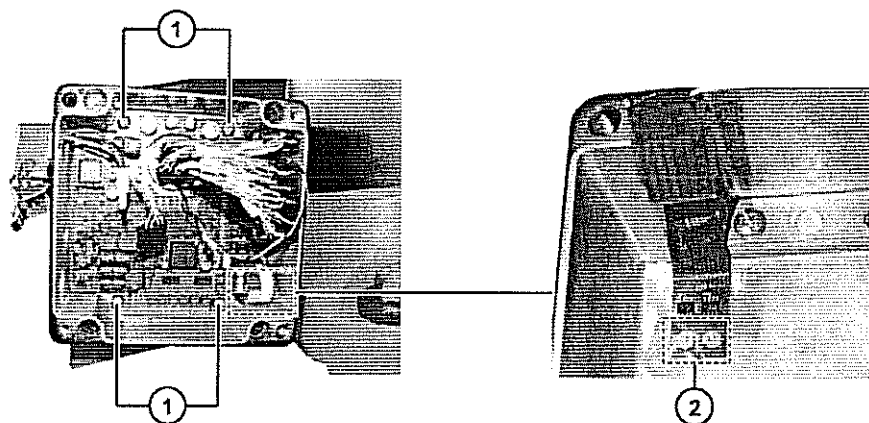


Fig. 11-28: RDC fastening

- 1 Fastening the RDC module: M6x10
Tightening torque: 2.0 Nm
- 2 Fastening the EDS: M2.5 plastic nuts
Tightening torque: 0.1 Ncm
5. Carefully remove the RDC module from the RDC box without tilting it.
6. Insert and fasten the new RDC module.
7. Connect all cables.
8. Plug in the EDS connection.
9. Close the lid of the RDC box and screw it firmly in place.

11.5 Exchanging the batteries

Procedure

1. Shut down the robot controller by means of the main menu item **Shut-down**. [Further information is contained in the operating and programming instructions for the KUKA System Software.]
2. Turn off the robot controller and take measures to prevent it from being turned on again unintentionally.
3. Disconnect the power cable from the supply.

WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

4. Remove the fastening screws of the cooling duct with a 7 mm socket wrench. Lift the cooling duct out vertically.

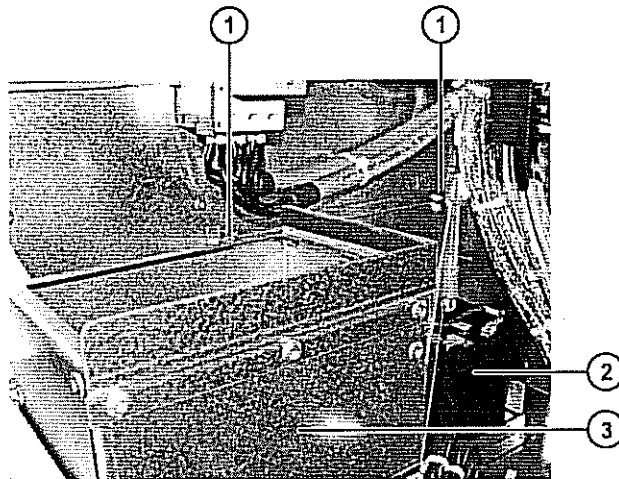


Fig. 11-29: Removing the cooling duct

- 1 Cooling duct fastening screws
- 2 Batteries
- 3 Cooling duct

5. Unplug the battery connection cables.

⚠ WARNING A short-circuit or short to ground at the battery poles causes a very high short-circuit current. This short-circuit current can cause severe injury and substantial damage to property. It must be ensured that no short-circuit or short to ground is caused at the battery poles.

⚠ WARNING A short-circuit or short to ground at the battery poles can trip the higher-level fuse. The batteries have no fuse of their own. It must be ensured that no short-circuit or short to ground is caused at the battery poles.

6. Remove the Velcro strip.

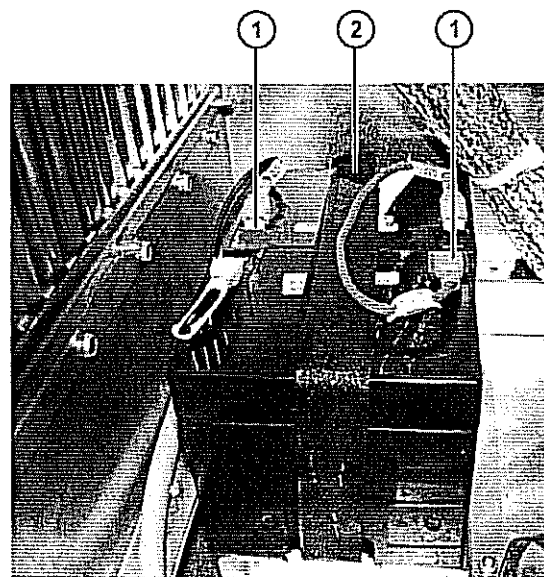


Fig. 11-30: Exchanging the batteries

- 1 Battery connection cables
- 2 Velcro strip

7. Take out both battery blocks.

i The battery blocks must both be exchanged together.

8. Insert the new battery blocks and plug in the battery connection cables.

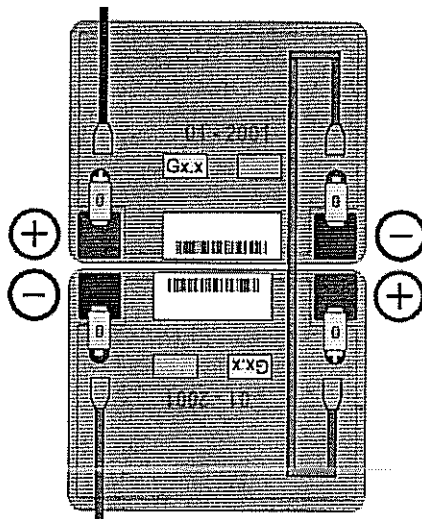


Fig. 11-31: Battery polarity

WARNING Observe the illustrated battery polarity. Installing the batteries in the wrong position or with reversed polarity can generate a high short-circuit current and trip the higher-level fuse.

9. Fasten the battery blocks with the Velcro strip.
10. Install the cooling duct and screw it firmly in place.

Storage

NOTICE To prevent exhaustive discharge and thus destruction of the batteries, the batteries must be recharged at regular intervals according to the storage temperature.
If the storage temperature is +20 °C or lower, the batteries must be recharged every 9 months.
If the storage temperature is between +20 °C and +30 °C, the batteries must be recharged every 6 months.
If the storage temperature is between +30 °C and +40 °C, the batteries must be recharged every 3 months.

11.6 Exchanging the low-voltage power supply unit

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- The power cable is de-energized.

WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- The controller has been shut down.

Procedure

1. Remove the rear panel.
2. Unplug the connections.

3. Loosen the fastening screws.
4. Tilt the low-voltage power supply unit forward and lift it out vertically.

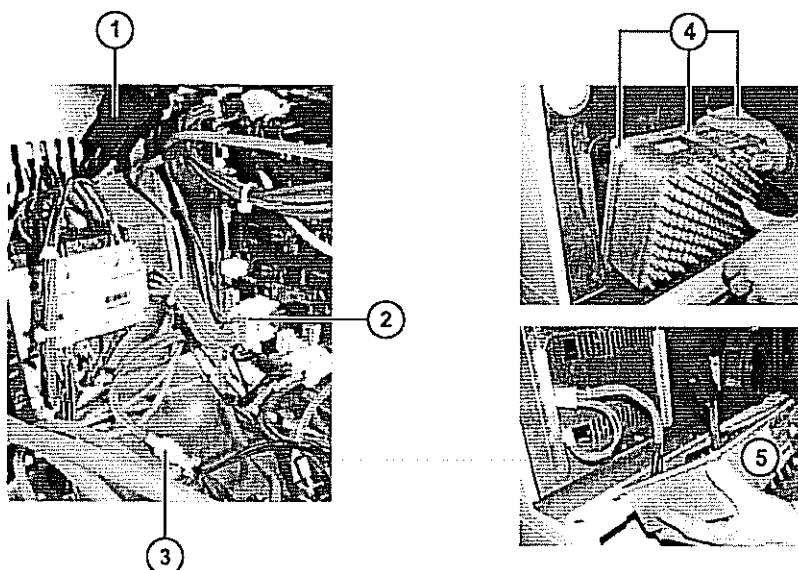


Fig. 11-32: Low-voltage power supply unit

- | | |
|---------------------------------|---|
| 1 Power supply connector X2 | 4 Fastening screws |
| 2 CCU power infeed connector X1 | 5 Low-voltage power supply unit removed |
| 3 XPE connector | |
5. Insert and fasten the new low-voltage power supply unit.
 6. Plug in the connectors; insert and fasten the rear panel.

11.7 Exchanging the pressure relief plug

Description The pressure relief plug is used to generate an overpressure inside the cabinet. This prevents excessive fouling of the cabinet.

Preconditions

- The robot controller must be switched off and secured to prevent unauthorized persons from switching it on again.
- The power cable must be de-energized.

⚠ WARNING Cables with white sheathing remain under mains voltage even with the main switch turned off! This mains voltage can cause life-threatening injuries on contact.

- Observe the ESD guidelines.

Procedure

1. Remove the foam ring.
2. Exchange the filter insert.
3. Insert the foam ring so that it is flush with the pressure relief plug.

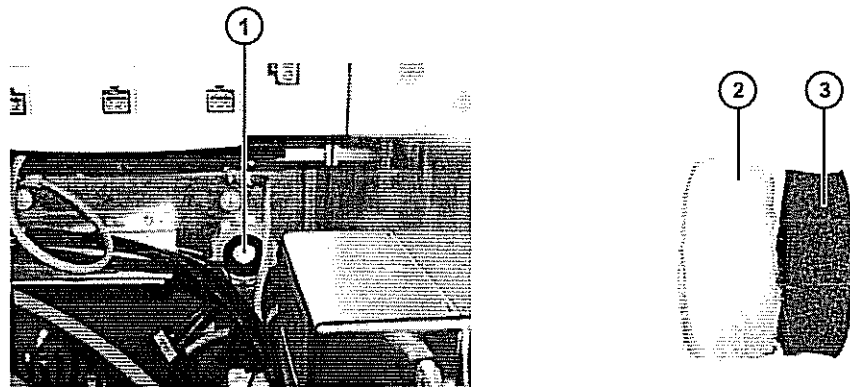


Fig. 11-33: Exchanging the pressure relief plug

- | | |
|------------------------|-------------|
| 1 Pressure relief plug | 3 Foam ring |
| 2 Filter insert | |

11.8 Installing the KUKA System Software (KSS)



Further information is contained in the operating and programming instructions for the KUKA System Software (KSS).

12 Troubleshooting

12.1 Cabinet Control Unit LED display

Overview

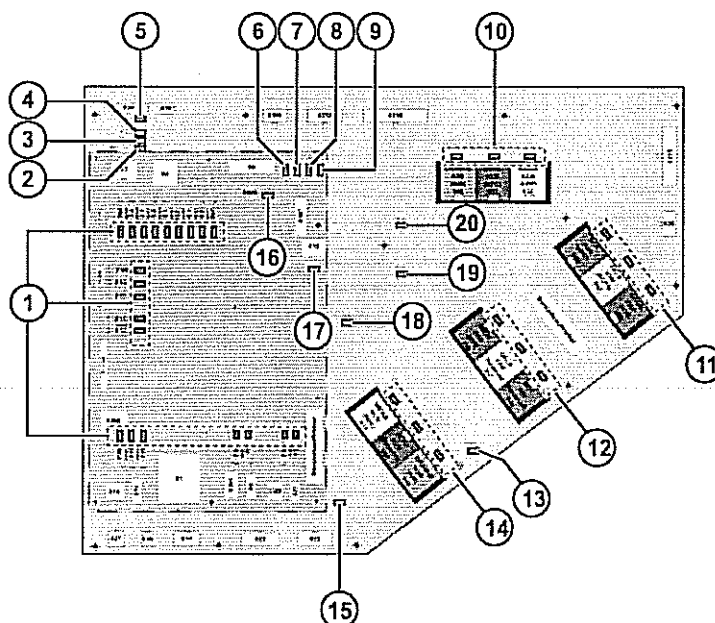


Fig. 12-1: CCU LED display

Item	Designation	Color	Description	Remedy
1	Fuse LEDs The LEDs indicate the status of the fuses.	Red	On = fuse defective	Exchange defective fuse
			Off = fuse OK	-
2	PWRS/3.3V	Green	On = power supply present	-
			Off = no supply voltage present	- Check fuse F17.3 - If the LED PWR/3.3V lights up, exchange the CCU module
3	STAS2 Safety node B	Orange	Off = no supply voltage present	- Check fuse F17.3 - If the LED PWR/3.3V lights up, exchange the CCU module
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	Check cabling at X309, X310, X312. For test purposes, disconnect the cables at X309, X310, X312 and switch the controller off and back on again. If the error recurs, exchange the module.

Item	Designation	Color	Description	Remedy
4	STAS1 Safety node A	Orange	Off = no supply voltage present	■ Check fuse F17.3 ■ If the LED PWR/3.3V lights up, exchange the CCU module
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	Check cabling at X309, X310, X312. For test purposes, disconnect the cables at X309, X310, X312 and switch the controller off and back on again. If the error recurs, exchange the module.
5	FSOE Safety protocol of the EtherCat connection	Green	Off = not active	-
			On = operational	-
			Flashing = fault code (internal)	-
6	27 V Voltage, main power supply unit, without battery backup	Green	Off = no supply voltage present	Check infeed at X1 (rated voltage 27.1 V)
			On = power supply present	-
7	PS1 Voltage, Power Supply 1 (short-duration battery backup)	Green	Off = no supply voltage present	■ Check infeed at X1 (rated voltage 27.1 V) ■ Drive bus switched off (BusPowerOff state)
			On = power supply present	-
8	PS2 Voltage, Power Supply 2 (medium-duration battery backup)	Green	Off = no supply voltage present	■ Check infeed at X1. ■ Controller in Sleep state
			On = power supply present	-
9	PS3 Voltage, Power Supply 3 (long-duration battery backup)	Green	Off = no supply voltage present	Check infeed at X1.
			On = power supply present	-

Item	Designation	Color	Description	Remedy
10	L/A KSB (SIB)	Green	■ On = physical connection. Network cable plugged in ■ Off = no physical connection. Network cable not plugged in ■ Flashing = data traffic on the line	-
	L/A KCB (KPC)	Green		
	L/A KCB (KPP)	Green		
11	L/A	Green		
	L/A	Green		
	L/A	Green		
12	L/A	Green		
	L/A	Green		
	L/A	Green		
13	PWR/3.3V Power for the CIB	Green	Off = no supply voltage present	■ Check fuse F17.3 ■ Jumper plug X308 present ■ Check fuse F308 ■ In the case of external supply via X308: check external supply voltage (rated voltage 24 V)
			On = supply voltage present	-
14	L/A	Green	■ On = physical connection ■ Off = no physical connection. Network cable not plugged in. ■ Flashing = data traffic on the line	-
	L/A	Green		
	L/A	Green		
15	STA1 (CIB) µC I/O node	Orange	Off = no supply voltage present	■ Check fuse F17.3 ■ If the LED PWR/3.3V lights up, exchange the CCU module
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	Exchange CCU module
16	STA1 (PMB) µC USB	Orange	Off = no supply voltage present	■ Check infeed at X1 ■ If the LED PWR/5V lights up, exchange the CCU module
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	Exchange CCU module

Item	Designation	Color	Description	Remedy
17	PWR/5V Supply for PMB	Green	Off = no supply voltage present	Check infeed at X1 (rated voltage 27.1 V)
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	-
18	STA2 FPGA node	Orange	Off = no supply voltage present	■ Check infeed at X1 ■ If the LED PWR/3.3V lights up, exchange the CCU module
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	Exchange CCU module
19	RUN SION EtherCat Safety nodes	Green	On = operational (normal state)	-
			Off = Init (after switching on)	-
			Flashing at 2.5 Hz = Pre-Op (intermediate state on startup)	-
			Single signal = Safe Op	-
			Flashing at 10 Hz = boot (for firmware update)	-
20	RUN CIB EtherCat AT _μ C I/O node	Green	On = operational (normal state)	-
			Off = Init (after switching on)	-
			Flashing at 2.5 Hz = Pre-Op (intermediate state on startup)	-
			Single signal = Safe Op	-
			10 Hz = boot (for firmware update)	-

12.2 Cabinet Control Unit fusing

Overview

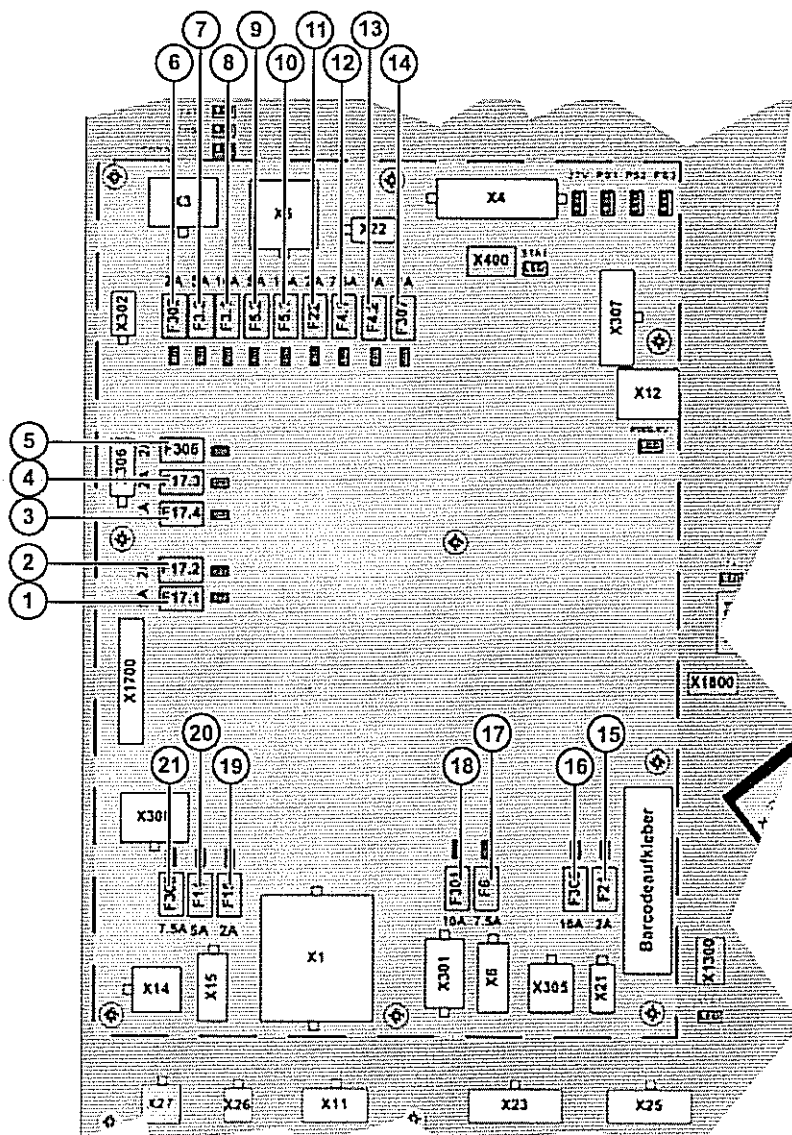


Fig. 12-2: Arrangement of the fuses



A defective fuse is indicated by a red LED next to the fuse. Once the cause of the fault has been eliminated, defective fuses must be replaced with fuses with the value specified in the operating instructions or printed on the module.

Item	Designation	Description	Fusing
1	F17.1	Contactor outputs 1 ... 4 CCU	5 A
2	F17.2	CCU inputs	2 A
3	F17.4	CCU safe inputs	2 A
4	F17.3	CCU logic	2 A
5	F306	SmartKCP supply	2 A
6	F302	SIB power supply	5 A
7	F3.2	KPP1 logic without battery backup	7.5 A
8	F3.1	KPP1 brakes without battery backup	15 A

Item	Designation	Description	Fusing
9	F5.2	KPP2 logic without battery backup/switch	7.5 A
10	F5.1	KPP2 brakes without battery backup	15 A
11	F22	Cabinet lighting (optional)	2 A
12	F4.1	KPC with battery backup	10 A
13	F4.2	KPC fan with battery backup	2 A
14	F307	CSP power supply	2 A
15	F21	RDC power supply	2 A
16	F305	Battery infeed	15 A
17	F6	24 V without battery back-up (optional)	7.5 A
18	F301	without battery backup, spare	10 A
19	F15	Internal fan (optional)	2 A
20	F14	External fan	7.5 A
21	F308	Internal power supply, external infeed with battery backup	7.5 A

12.3 Resolver Digital Converter LED display

Overview

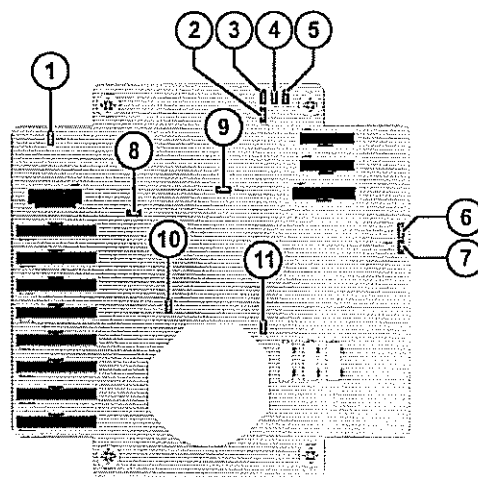


Fig. 12-3: RDC LED display

Item	Designation	Color	Description
1	STA3 Motor temperature micro-controller	Yellow	≡ Off = fault ≡ Flashing at 1 Hz = normal state ≡ Flashing = fault code (internal)
2	RUN EtherCAT AT bus	Green	≡ Off = Init ≡ On = normal state ≡ Flashing at 2.5 Hz = Pre-Op ≡ Single signal = Safe Op ≡ Flashing = fault code (internal) ≡ Flashing at 10 Hz = boot

Item	Designation	Color	Description
3	L/A1 Input of the KCB (X18)	Green	- Off = no physical connection. Network cable not plugged in. - On = network cable plugged in - Flashing = data traffic on the line
4	L/A2 Output of the KCB (X19)	Green	- Off = no physical connection. Network cable not plugged in. - On = network cable plugged in - Flashing = data traffic on the line
5	L/A3 Output of the KCB to the EMD (X20)	Green	- Off = no physical connection. Network cable not plugged in. - On = network cable plugged in - Flashing = data traffic on the line
6	STA4 VMT microcontroller	Yellow	- Off = fault - Flashing at 1 Hz = normal state - Flashing = fault code (internal)
7	PWR/3.3V RDC power supply	Green	- Off = no power - On = power supply connected
8	FSOE Safety protocol of the EtherCat connection	Green	- Off = not active - On = operational - Flashing = fault code (internal)
9	STA2 FPGA B integrated circuit	Yellow	- Off = fault - Flashing at 1 Hz = normal state - Flashing = fault code (internal)
10	STA1 FPGA A integrated circuit	Yellow	- Off = fault - Flashing at 1 Hz = normal state - Flashing = fault code (internal)
11	STA0 configuration microcontroller	Yellow	- Off = fault - Flashing at 1 Hz = normal state - Flashing = fault code (internal)

12.4 Controller System Panel LED display

Overview

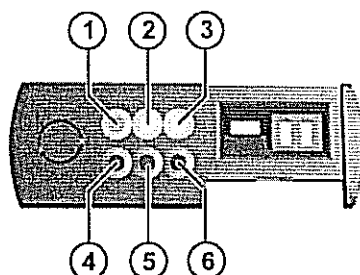


Fig. 12-4

Item	Designation	Description
1	LED1	Operating LED
2	LED2	Sleep LED
3	LED3	Automatic LED
4	LED4	Error LED

Item	Designation	Description
5	LED5	Error LED
6	LED6	Error LED

CSP test

Display	Description
	If all LEDs light up for 3 s after the CSP is switched on, it is working correctly

Automatic mode

Display	Description
	LED1 = on LED3 = on Controller is in Automatic mode
	LED1 = on Controller is not in Automatic mode

Sleep mode

Display	Description
	LED2 flashes slowly Controller is in Sleep mode.
	LED1 flashes slowly Controller is coming out of Sleep mode.

ProfiNet ping

Display	Description
	LED1 = on LED4 flashes slowly LED5 flashes slowly LED6 flashes slowly ProfiNet ping is being executed

12.5 Controller System Panel LED error display

Overview

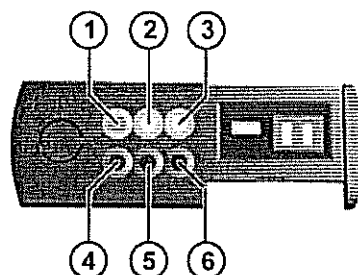


Fig. 12-5

Item	Designation	Description
1	LED1	Operating LED
2	LED2	Sleep LED
3	LED3	Automatic LED
4	LED4	Error LED

Item	Designation	Description
5	LED5	Error LED
6	LED6	Error LED

Error states

Display	Description	Remedy
	LED1 flashes slowly LED4 = on BIOS error	Exchange the PC
	LED1 flashes slowly LED5 = on Timeout booting Windows or starting the PMS	▣ Exchange the hard drive ▣ Reload the image
	LED1 flashes slowly LED6 = on Timeout waiting for RTS "RUNNING"	▣ Reload the image ▣ Run setup
	LED1 flashes slowly Timeout waiting for HMI Ready	-

12.6 LAN Onboard LED display

Overview

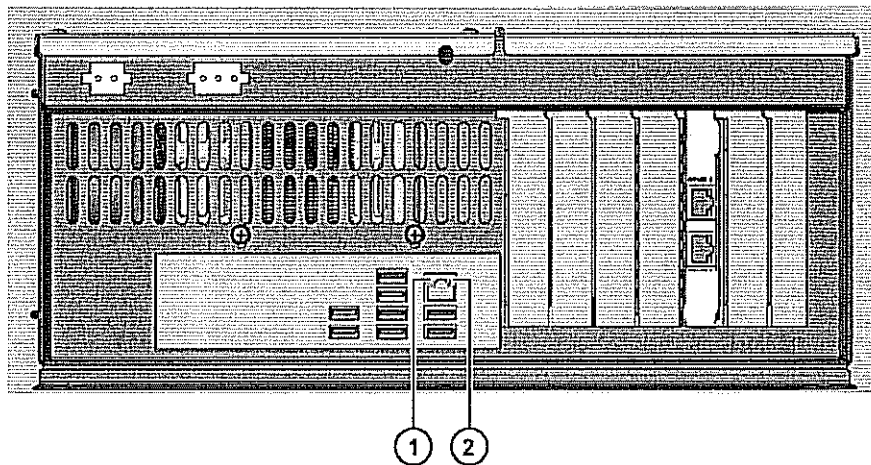


Fig. 12-6: LAN Onboard LED display

Item	Designation	Color	Description
1	Activity/Link	Green	▣ Off = no connection ▣ On = connection established ▣ Flashing = connection active
2	Speed	Yellow/ green	▣ Off = 10 Mb ▣ Green = 100 Mb ▣ Yellow = 1000 Mb

12.7 Safety Interface Board LED display

Standard

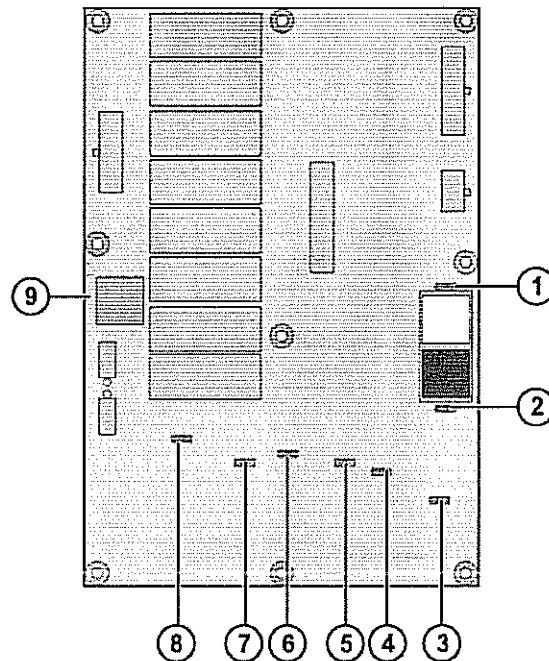


Fig. 12-7: Standard SIB LED display

Item	Designation	Color	Description	Remedy
1	L/A	Green	≡ On = physical connection ≡ Off = no physical connection. Network cable not plugged in. ≡ Flashing = data traffic on the line	-
2	L/A	Green		
3	PWR_3V3 Power for the SIB	Green	Off = no supply voltage present	≡ Check fuse F302 ≡ Jumper plug X308 present
			On = supply voltage present	-
4	RUN EtherCat Safety nodes	Green	On = operational (normal state)	-
			Off = Init (after switching on)	-
			Flashing at 2.5 Hz = Pre-Op (intermediate state on startup)	-
			Single signal = Safe Op	-
			Flashing at 10 Hz = boot (for firmware update)	-

Item	Designation	Color	Description	Remedy
5	STAS2 Safety node B	Orange	Off = no supply voltage present	- Check fuse F302 - If the LED PWR_3V3 lights up, exchange the SIB board
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	-
6	FSOE Safety protocol of the EtherCat connection	Green	Off = not active	-
			On = operational	-
			Flashing = fault code (internal)	-
7	STAS1 Safety node A	Orange	Off = no supply voltage present	- Check fuse F302 - If the LED PWR_3V3 lights up, exchange the SIB board
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	-
8	PWRS 3.3V	Green	On = supply voltage present	-
			Off = no supply voltage present	- Check fuse F302 - If the LED PWR_3V3 lights up, exchange the SIB board
9	Fuse LED The LED indicates the status of the fuse	Red	On = fuse defective	Exchange defective fuse
			Off = fuse OK	-

Extended

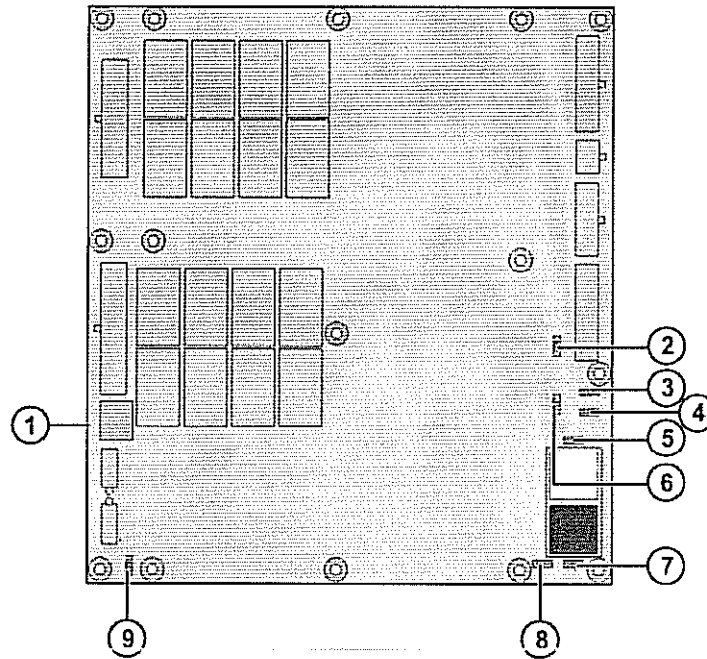


Fig. 12-8: Extended SIB LED display

Item	Designation	Color	Description	Remedy
1	Fuse LED The LED indicates the status of the fuse	Red	On = fuse defective	Exchange defective fuse
			Off = fuse OK	-
2	STAS1 Safety node A	Orange	Off = no supply voltage present	≡ Check fuse F302 ≡ If the LED PWR +3V3 lights up, exchange the SIB board
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	-
3	FSOE Safety protocol of the EtherCat connection	Green	Off = not active	-
			On = operational	-
			Flashing = fault code (internal)	-
4	PWRS_+3V3 V	Green	On = supply voltage present	-
			Off = no supply voltage present	≡ Check fuse F302 ≡ If the LED PWR +3V3 lights up, exchange the SIB board

Item	Designation	Color	Description	Remedy
5	L/A	Green	■ On = physical connection ■ Off = no physical connection. Network cable not plugged in. ■ Flashing = data traffic on the line	-
6	STAS2 Safety node B	Orange	Off = no supply voltage present	■ Check fuse F302 ■ If the LED PWR +3V3 lights up, exchange the SIB board
			Flashing at 1 Hz = normal state	-
			Flashing at 10 Hz = boot phase	-
			Flashing = fault code (internal)	-
7	L/A	Green	■ On = physical connection ■ Off = no physical connection. Network cable not plugged in. ■ Flashing = data traffic on the line	-
8	RUN EtherCat Safety nodes	Green	On = operational (normal state)	-
			Off = Init (after switching on)	-
			Flashing at 2.5 Hz = Pre-Op (intermediate state on startup)	-
			Single signal = Safe Op	-
			Flashing at 10 Hz = boot (for firmware update)	-
9	PWR +3V3 Power for the SIB	Green	Off = no supply voltage present	■ Check fuse F260 ■ Jumper plug X308 present
			On = supply voltage present	-

12.8 Safety Interface Board fuses

Semiconductor fuse

Every output channel is fitted with self-resetting semiconductor fuses to guard against short-circuits.

To reset the semiconductor fuse, the following steps are to be carried out:

- Eliminate the cause of the error
- De-energize the semiconductor fuse for 5 s

 The semiconductor fuses are not rated for frequent use and should not be tripped intentionally, as this will reduce their service life.

Standard SIB

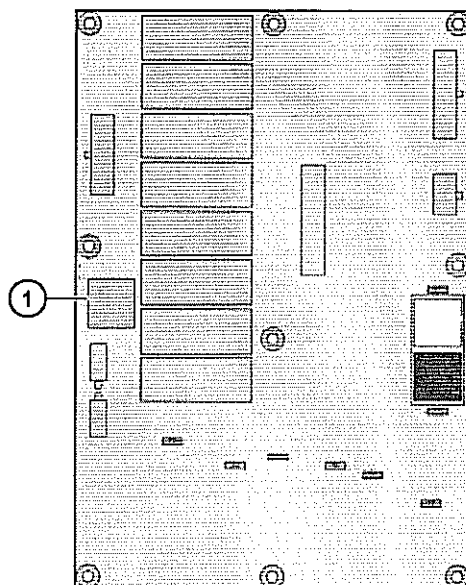


Fig. 12-9: Standard SIB fuse



A defective fuse is indicated by a red LED next to the fuse. Once the cause of the fault has been eliminated, defective fuses must be replaced with fuses with the value specified in the operating instructions or printed on the module.

Item	Designation	Description	Fusing
1	F250	Test signal power supply, safe inputs and relay activation	4 A

Extended SIB

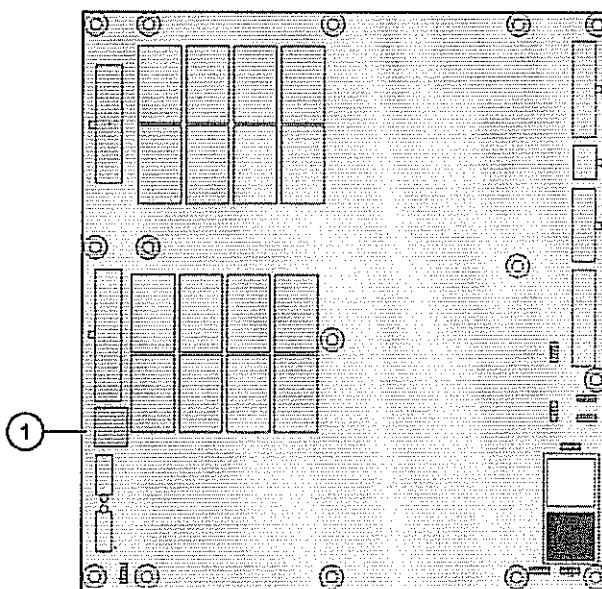


Fig. 12-10: Extended SIB fuse



A defective fuse is indicated by a red LED next to the fuse. Once the cause of the fault has been eliminated, defective fuses must be replaced with fuses with the value specified in the operating instructions or printed on the module.

Item	Designation	Description	Fusing
1	F260	Test signal power supply, safe inputs and relay activation	4 A

12.9 Checking the KUKA Servo Pack

Description The KSP LED display consists of the following LED groups:

- KSP device status
- Axis control
- Communication status

If faults occur during the initialization phase, the middle axis control LEDs flash. All other LEDs are off. The red axis control LED is lit continuously and the green axis control LED flashes at 2 to 16 Hz, followed by a pause.

If defective firmware is detected during the initialization phase, the red device status LED is lit and the green device status LED is dimmed.

Precondition

WARNING The robot controller is energized (50-600 V) when it is switched on. This voltage can cause life-threatening injuries on contact. Work and measurements on the electrical equipment may only be carried out by specially trained personnel.

Procedure

1. Check communication status LED group.
2. Check KSP device status LED group.
3. Check axis control LED group.

Overview

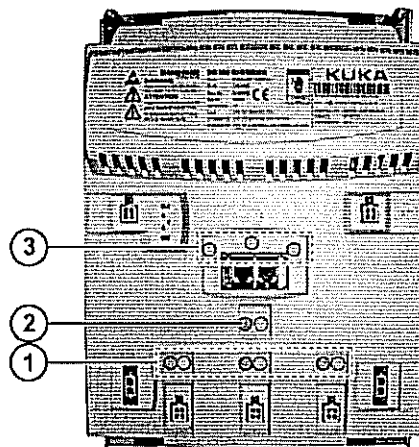


Fig. 12-11: KSP LED display

- | | |
|--------------------------------|-----------------------------------|
| 1 LED group: axis control | 3 LED group: communication status |
| 2 LED group: KSP device status | |

Device status

Red LED	Green LED	Meaning
Off	Off	No power supply to the control electronics
On	Off	Fault in the KSP
Off	Flashing	No communication with the controller
Off	On	Communication with the controller

Axis control

Red LED	Green LED	Meaning
Off	Off	No power supply to the control electronics Axis not present
On	Off	Fault in the axis
Off	Flashing	No servo enable
Off	On	Servo enable

Communication The green communication LEDs indicate the status of the bus connection.

12.10 Checking the KUKA Power Pack**Description**

The KPP LED display consists of the following LED groups:

- Power supply
- KPP device status
- Axis control
- Communication status

If faults occur during the initialization phase, the middle axis control LEDs flash. All other LEDs are off. The red axis control LED is lit continuously and the green axis control LED flashes at 2 to 16 Hz, followed by a pause.

If defective firmware is detected during the initialization phase, the red device status LED is lit and the green device status LED is dimmed.

Precondition

WARNING The robot controller is energized (50-600 V) when it is switched on. This voltage can cause life-threatening injuries on contact. Work and measurements on the electrical equipment may only be carried out by specially trained personnel.

Procedure

1. Check power supply LED group.
2. Check communication status LED group.
3. Check KSP device status LED group.
4. Check axis control LED group.

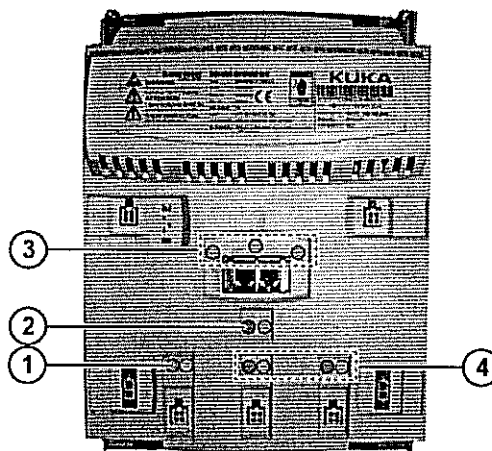
Overview

Fig. 12-12: KPP LED display

- | | |
|--------------------------------|-----------------------------------|
| 1 LED group: power supply | 3 LED group: communication status |
| 2 LED group: KPP device status | 4 LED group: axis control |

Power supply

Red LED	Green LED	Meaning
Off	Off	No power supply to the control electronics
On	Off	Fault in the power supply
Off	Flashing	Intermediate circuit voltage out of the permitted range
Off	On	Intermediate circuit voltage within the permitted range

Device status

Red LED	Green LED	Meaning
Off	Off	No power supply to the control electronics
On	Off	Fault in the KPP
Off	Flashing	No communication with the controller
Off	On	Communication with the controller

Axis control

Red LED	Green LED	Meaning
Off	Off	No power supply to the control electronics Axis not present
On	Off	Fault in the axis
Off	Flashing	No servo enable
Off	On	Servo enable

Communication The green communication LEDs indicate the status of the bus connection.

12.11 KPP and KSP error messages**Description**

The error messages have corresponding acknowledgement messages.

- In these messages, %1 stands for the device type (KSP or KPP).
- In these messages, %2 stands for the number of the drive or power supply (KSP or KPP).
- %3 stands for error codes for further differentiation of the cause of the error.

Error no.	Error	Cause	Remedy
26030	Device state: OK	-	-
26031	Internal error, KPP/KSP (axis)	The device has detected an internal error.	■ Reinitialize the drive bus: Power Off / Power On ■ Check KPP (see LEDs)

Error no.	Error	Cause	Remedy
26032	I _{xT} overload error, KPP/KSP (axis)	Axis overloaded	■ During start-up => excessive load in program ■ Reinitialize the drive bus: Power Off / Power On ■ During operation ■ Modifications to system ■ Check machine ■ Temperature influences ■ Check trace recording of axis/ current ■ Adapt program velocity ■ Check CBS pressure ■ Check gear unit
		Mean continuous current too high	
		Power	
		Excessive load	
26033	Ground fault, KPP/KSP (axis)	Power unit overcurrent (ground fault)	■ Check motor cable ■ Check motor ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26034	Overcurrent, KPP/KSP (axis)	Fault that briefly results in an overcurrent that exceeds the maximum current of the KPP (short-circuit,...)	■ Check trace recording of axis/ current ■ Check motor ■ Check motor cable ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26035	Intermediate circuit voltage too high, KPP/KSP (axis)	Overvoltage in intermediate circuit during operation	■ Check trace recording of the intermediate circuit ■ Check mains voltage ■ Check ballast switch ■ Excessive load during braking => reduce ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26036	Intermediate circuit voltage too low, KPP/KSP (axis)	Undervoltage in intermediate circuit during operation	■ Check trace recording of the intermediate circuit ■ Check mains voltage ■ Check intermediate circuit cabling ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP charging circuit

Error no.	Error	Cause	Remedy
26037	Logic supply voltage too high, KPP/KSP (axis)	Overvoltage in 27 V supply	▣ Check 27 V supply ▣ Check power supply to 27 V power supply unit ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26038	Logic supply voltage too low, KPP/KSP (axis)	Undervoltage in 27 V supply	▣ Check 27 V supply ▣ Check power supply to 27 V power supply unit ▣ Check battery ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26039	Device temperature too high, KPP/KSP (axis)	Overtemperature	▣ Check cabinet fan ▣ Check ambient temperature ▣ Load in program too high, check load ▣ Dirt in cooling circuit => clean ▣ Check PC fan ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26040	Heat sink temperature too high, KPP/KSP (axis)	Overtemperature, heat sink	▣ Check cabinet fan ▣ Check ambient temperature ▣ Load in program too high, check and reduce load ▣ Dirt in cooling circuit => clean ▣ Check installation site, ventilation slits and clearance ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26041	Motor phase failure, KPP/KSP (axis)	Failure of motor phase	▣ Check motor cable ▣ Check motor ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP
26042	Communication error, KPP/KSP (axis)	Communication error on the controller bus	▣ Reinitialize the drive bus: Power Off / Power On ▣ Check EtherCat cabling ▣ Check EtherCat stack ▣ Check CCU ▣ Check KPP ▣ Check KSP

Error no.	Error	Cause	Remedy
26043	Unknown status flag received, KPP/KSP (axis)	Software error, Ether-Cat master	-
26044	Unknown device status, KPP/KSP (axis)	-	-
26045	Hardware fault, KPP/KSP (axis)	The device has detected an internal hardware fault.	▣ Reinitialize the drive bus: Power Off / Power On ▣ Check device (see LEDs) ▣ Exchange device
26046	Mains phase failure, KPP/KSP (axis)	Failure of mains phase	▣ Check power lead ▣ Check KPP cabling ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP
26047	Power supply failure, KPP/KSP (axis)	Failure, supply voltage below 300 V	▣ Check power lead ▣ Check KPP cabling ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP
26048	Overvoltage during charging, KPP/KSP (axis)	-	▣ Mains voltage too high ▣ Too few capacitors connected (too few modules) ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP
26050	Fault in brake resistor, KPP/KSP (axis)	KPP has detected an error in the ballast circuit	▣ Check ballast resistor ▣ Check cabling between KPP and ballast resistor ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP
26051	Ballast circuit overload, KPP/KSP (axis)	Braking energy permanently too high	▣ Reduce heavy loads that are braked too frequently ▣ Check ballast resistor ▣ Check cabling between KPP and ballast resistor ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP

Error no.	Error	Cause	Remedy
26130	Intermediate circuit charging failed, KPP/KSP (axis)	-	▣ Check intermediate circuit cabling ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26132	Collective brake fault, KPP/KSP (axis)	Brake cable monitoring device has signaled short-circuit, overloading or break in connection. / short-circuit / overcurrent / no brake connected	▣ Check brake voltage => fault in all axes ▣ Check motor / brake (measure) ▣ Check brake cable / motor cable ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP

12.12 KPP and KSP warning messages

- Description** The warning messages have corresponding acknowledgement messages.
- ▣ In these messages, %1 stands for the device type (KSP or KPP).
 - ▣ In these messages, %2 stands for the number of the drive or power supply (KSP or KPP).
 - ▣ %3 stands for error codes for further differentiation of the cause of the error.

Error no.	Warning	Cause	Remedy
26102	Device state: OK	-	-
26103	Internal error, KPP/KSP (axis)	The device has detected an internal error.	▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP (see LEDs)
26104	IxT overload error, KPP/KSP (axis)	Axis overloaded	▣ During start-up => excessive load in program ▣ Reinitialize the drive bus: Power Off / Power On ▣ During operation ▣ Modifications to system ▣ Check machine ▣ Temperature influences ▣ Check trace recording of axis/ current ▣ Adapt program velocity ▣ Check CBS pressure ▣ Check gear unit
		Mean continuous current too high	
		Power	
		Excessive load	
26105	Ground fault, KPP/KSP (axis)	Power unit overcurrent (ground fault)	▣ Check motor cable ▣ Check motor ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP

Error no.	Warning	Cause	Remedy
26106	Overcurrent, KPP/KSP (axis)	Fault that briefly results in an overcurrent that exceeds the maximum current of the KPP (short-circuit,...)	■ Check trace recording of axis/ current ■ Check motor ■ Check motor cable ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26107	Intermediate circuit voltage too high, KPP/KSP (axis)	Overvoltage in intermediate circuit during operation	■ Check trace recording of the intermediate circuit ■ Check mains voltage ■ Check ballast switch ■ Excessive load during braking => reduce ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26108	Intermediate circuit voltage too low, KPP/KSP (axis)	Undervoltage in intermediate circuit during operation	■ Check trace recording of the intermediate circuit ■ Check mains voltage ■ Check intermediate circuit cabling ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP charging circuit
26109	Logic supply voltage too high, KPP/KSP (axis)	Overvoltage in 27 V supply	■ Check 27 V supply ■ Check power supply to 27 V power supply unit ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26110	Logic supply voltage too low, KPP/KSP (axis)	Undervoltage in 27 V supply	■ Check 27 V supply ■ Check power supply to 27 V power supply unit ■ Check battery ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP

Error no.	Warning	Cause	Remedy
26111	Device temperature too high, KPP/KSP (axis)	Overtemperature	▣ Check cabinet fan ▣ Check ambient temperature ▣ Load in program too high, check load ▣ Dirt in cooling circuit => clean ▣ Check PC fan ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26112	Heat sink temperature too high, KPP/KSP (axis)	Overtemperature, heat sink	▣ Check cabinet fan ▣ Check ambient temperature ▣ Load in program too high, check and reduce load ▣ Dirt in cooling circuit => clean ▣ Check installation site, ventilation slits and clearance ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP ▣ Check KPP
26113	Motor phase failure, KPP/KSP (axis)	Failure of motor phase	▣ Check motor cable ▣ Check motor ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KSP
26114	Communication error, KPP/KSP (axis)	Communication error on the controller bus	▣ Reinitialize the drive bus: Power Off / Power On ▣ Check EtherCat cabling ▣ Check EtherCat stack ▣ Check CCU ▣ Check KPP ▣ Check KSP
26115	Unknown status flag received, KPP/KSP (axis)	Software error, EtherCat master	-
26116	Unknown device status, KPP/KSP (axis)	-	-
26117	Hardware fault, KPP/KSP (axis)	The device has detected an internal hardware fault.	▣ Reinitialize the drive bus: Power Off / Power On ▣ Check device (see LEDs) ▣ Exchange device
26118	Mains phase failure, KPP/KSP (axis)	Failure of mains phase	▣ Check power lead ▣ Check KPP cabling ▣ Reinitialize the drive bus: Power Off / Power On ▣ Check KPP

Error no	Warning	Cause	Remedy
26119	Power supply failure, KPP/KSP (axis)	Failure, supply voltage below 300 V	■ Check power lead ■ Check KPP cabling ■ Reinitialize the drive bus: Power Off / Power On ■ Check KPP
26120	Overvoltage during charging, KPP/KSP (axis)	-	■ Mains voltage too high ■ Too few capacitors connected (too few modules) ■ Reinitialize the drive bus: Power Off / Power On ■ Check KPP ■ Check KSP, improbable
26122	Fault in brake resistor, KPP/KSP (axis)	KPP has detected an error in the ballast circuit	■ Check ballast resistor ■ Check cabling between KPP and ballast resistor ■ Reinitialize the drive bus: Power Off / Power On ■ Check KPP
26123	Ballast circuit overload, KPP/KSP (axis)	Braking energy permanently too high	■ Reduce heavy loads that are braked too frequently ■ Check ballast resistor ■ Check cabling between KPP and ballast resistor ■ Reinitialize the drive bus: Power Off / Power On ■ Check KPP
26131	Intermediate circuit charging failed, KPP/KSP (axis)	-	■ Check intermediate circuit cabling ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP ■ Check KPP
26133	Collective brake fault, KPP/KSP (axis)	Brake cable monitoring device has signaled short-circuit, overloading or break in connection. / short-circuit / overcurrent / no brake connected	■ Check brake voltage => fault in all axes ■ Check motor / brake (measure) ■ Check brake cable / motor cable ■ Reinitialize the drive bus: Power Off / Power On ■ Check KSP

13 Decommissioning, storage and disposal

13.1 Decommissioning

Description	This section describes all the work required for decommissioning the robot controller if the robot controller is to be removed from the system. After decommissioning, it is prepared for storage or for transportation to a different location. Following its removal, the robot controller may only be transported with lifting tackle and a fork lift truck or pallet truck.
Precondition	■ The removal site must be accessible with a crane or with a fork lift truck for transportation. ■ The crane and fork lift truck have an adequate carrying capacity. ■ There is no hazard posed by system components.
Procedure	1. Release and unplug all peripheral connections. 2. Release and unplug motor cable connector and control cable connector. 3. Disconnect the ground conductor. 4. Prepare the robot controller for storage.

13.2 Storage

Preconditions	If the robot controller is to be put into long-term storage, the following points must be observed: ■ The place of storage must be as dry and dust-free as possible. ■ Avoid temperature fluctuations. ■ Avoid wind and drafts. ■ Avoid condensation. ■ Observe and comply with the permissible temperature ranges for storage. ■ Select a storage location in which the packaging materials cannot be damaged. ■ Only store the robot controller indoors.
Procedure	1. Clean robot controller. No dirt may remain on or in the robot controller. 2. Inspect the robot controller, both internally and externally, for damage. 3. Remove batteries and store in accordance with the manufacturer's instructions. 4. Remove any foreign bodies. 5. Remove any corrosion expertly. 6. Attach all covers to the robot controller and check that the seals are correctly in place. 7. Seal off electrical connections with suitable covers. 8. Cover the robot controller with plastic film and seal it against dust. If necessary, add a desiccant beneath the sheeting.

13.3 Disposal

When the robot controller reaches the end of its useful life, it can be dismantled, and the materials can be disposed of properly by type.

The following table provides an overview of the materials used in the robot controller. Some of the plastic components are marked with a material designation and must be disposed of accordingly.



As the end user, the customer is legally required to return depleted batteries. Used batteries can be returned to the vendor or brought to the designated collection points (e.g. in communal refuse collection facilities or commercial centers) free of charge. The batteries can also be sent to the vendor by post.

The following symbols can be found on the batteries:

- ≡ Crossed-out garbage can: battery must not be disposed of with ordinary household refuse.



- ≡ Pb: battery contains more than 0.004 lead by weight.
- ≡ Cd: battery contains more than 0.002 cadmium by weight.
- ≡ Hg: battery contains more than 0.0005 mercury by weight.

Material, designation	Subassembly, component	Note
Steel	Screws and washers, robot controller housing	-
PUR	Cable sheaths	-
ETFE	Flexible tube	-
Copper	Electrical cables, wires	-
EPDM	Seals and covers	-
CuZn (gold-plated)	Connectors, contacts	Dispose of without dismantling
Steel (ST 52-3)	Allen screws, washers	-
PE	Cable straps	-
Electrical components	Bus modules, boards, sensors	Dispose of as electrical scrap without disassembling

14 KUKA Service

14.1 Requesting support

Introduction The KUKA Roboter GmbH documentation offers information on operation and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.

Information The following information is required for processing a support request:

- Model and serial number of the robot
- Model and serial number of the controller
- Model and serial number of the linear unit (if applicable)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software
- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

14.2 KUKA Customer Support

Availability KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.

Argentina Ruben Costantini S.A. (Agency)
Luis Angel Huergo 13 20
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